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Revazova et al.

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(54) **OXYGEN TENSION FOR THE PARTHENOGENIC ACTIVATION OF HUMAN OOCYTES FOR THE PRODUCTION OF HUMAN EMBRYONIC STEM CELLS**

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(51) **Int. Cl.**
C12N 15/00 (2006.01)

(52) **U.S. Cl.** **435/373**; 435/325

(58) **Field of Classification Search** ..... None
See application file for complete search history.

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(74) *Attorney, Agent, or Firm*—DLA Piper LLP (US)

(57) **ABSTRACT**

Methods of producing human stem cells are disclosed for parthenogenetically activating human oocytes by manipulation of O_2 tension, including manipulation of Ca^{2+} under high O_2 tension and contacting oocytes with serine threonine kinase inhibitors under low O_2 tension, isolating inner cell masses (ICMs) from the activated oocytes, and culturing the cells of the isolated ICMs under high O_2 tension. Moreover, methods are described for the production of stems cells from activated oocytes in the absence of non-human animal products, including the use of human feeder cells/products for culturing ICM/stem cells. Stem cells produced by the disclosed methods are also described.

26 Claims, 18 Drawing Sheets

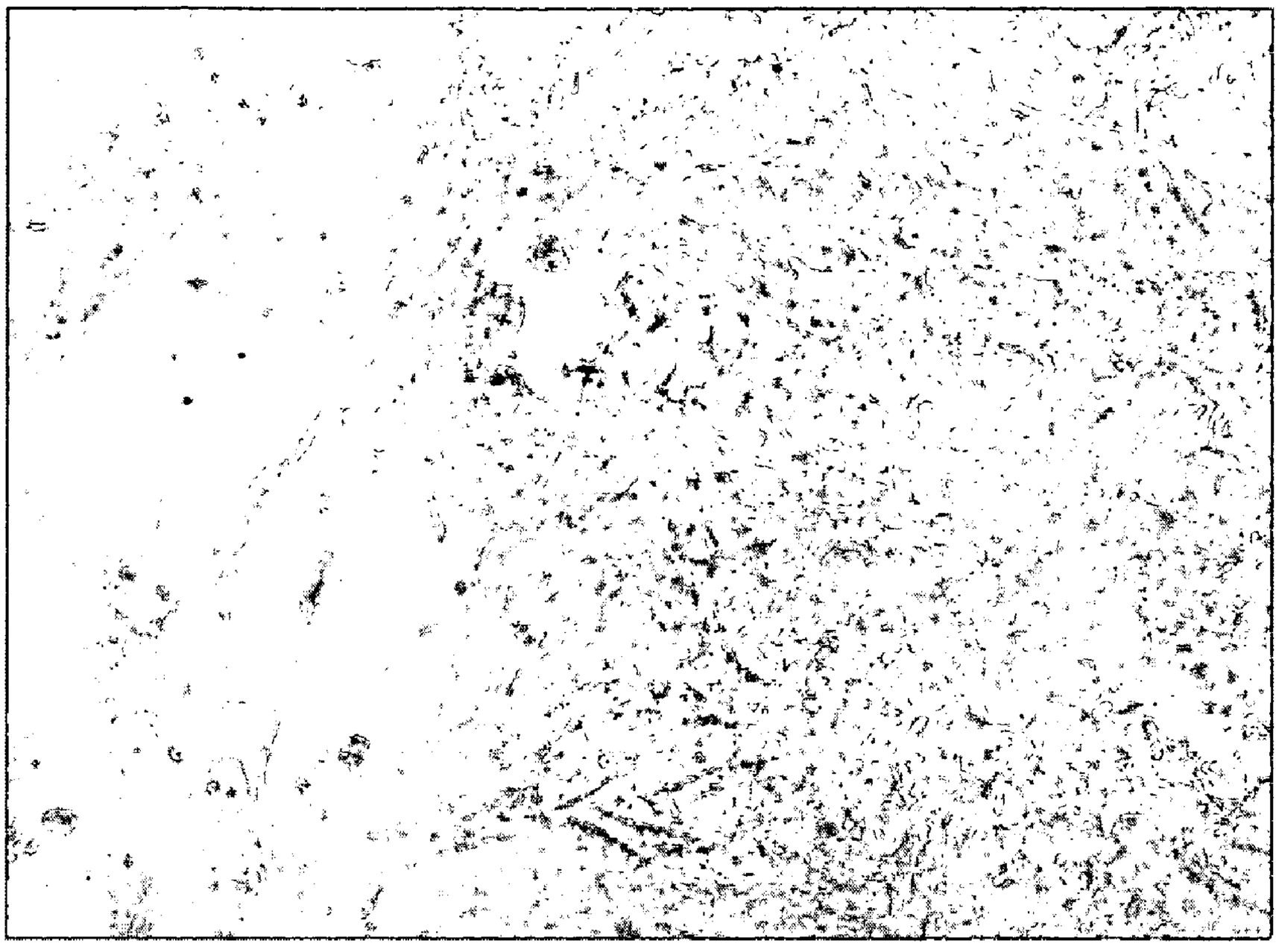


FIG. 1A

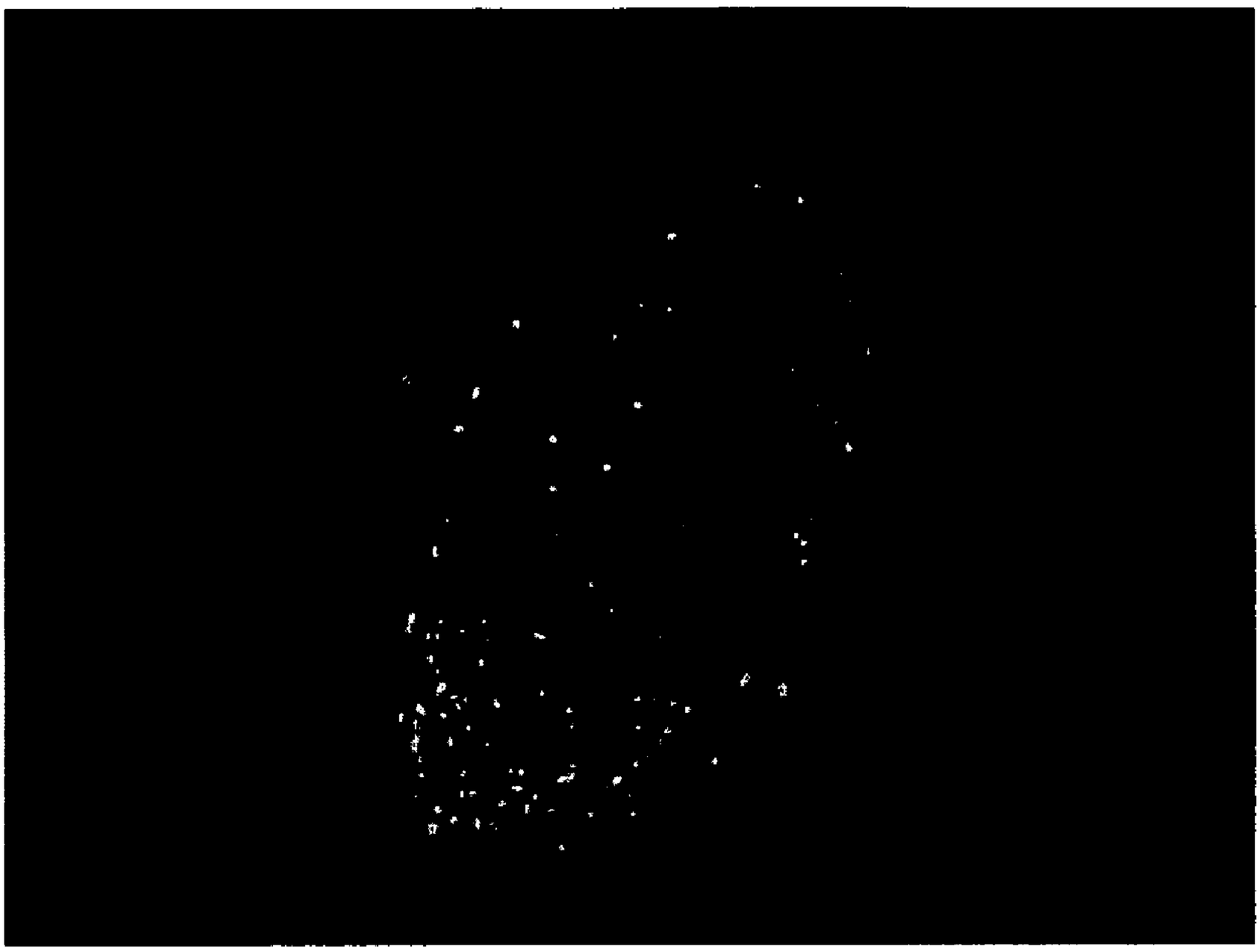


FIG. 1B

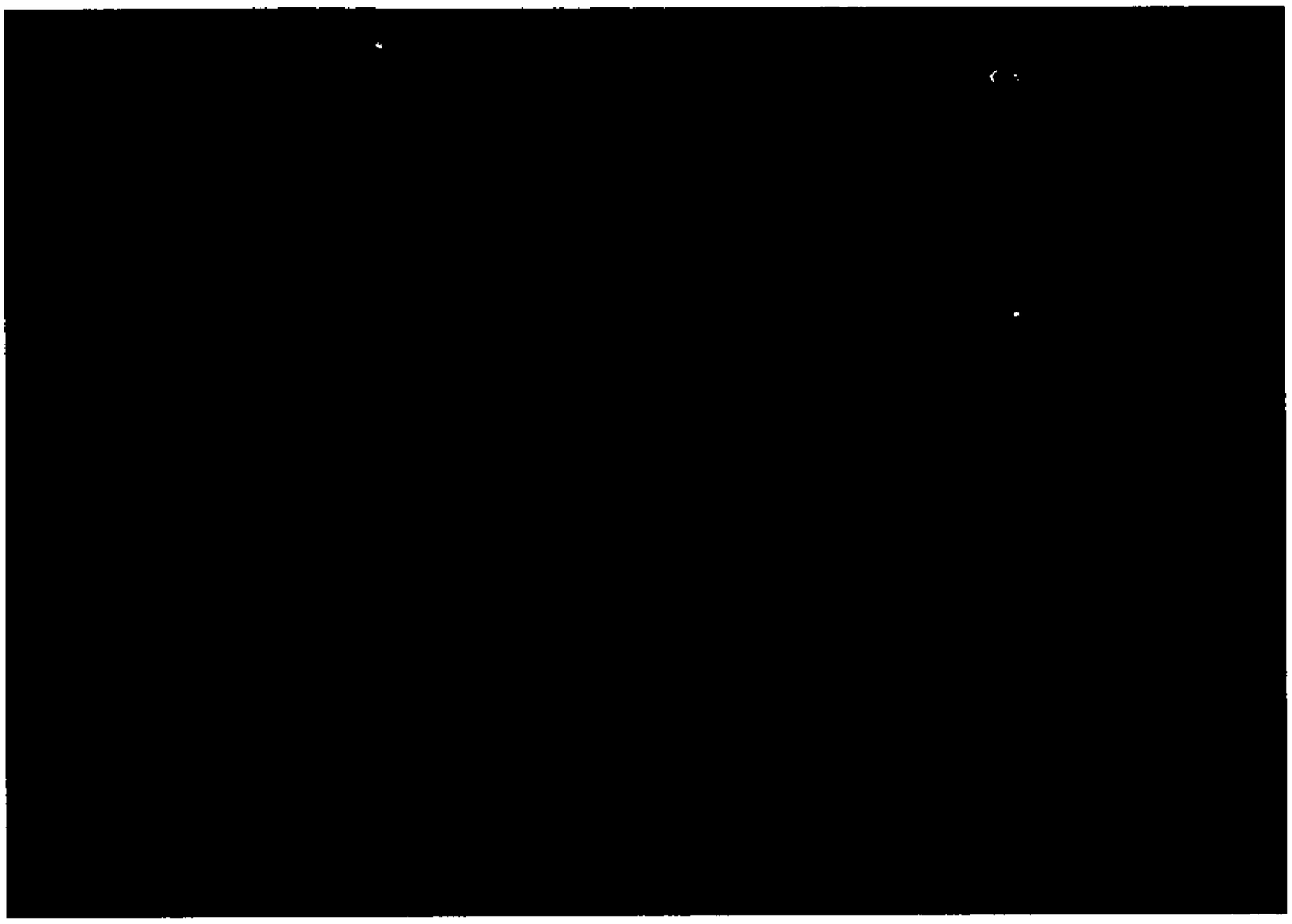


FIG. 1C

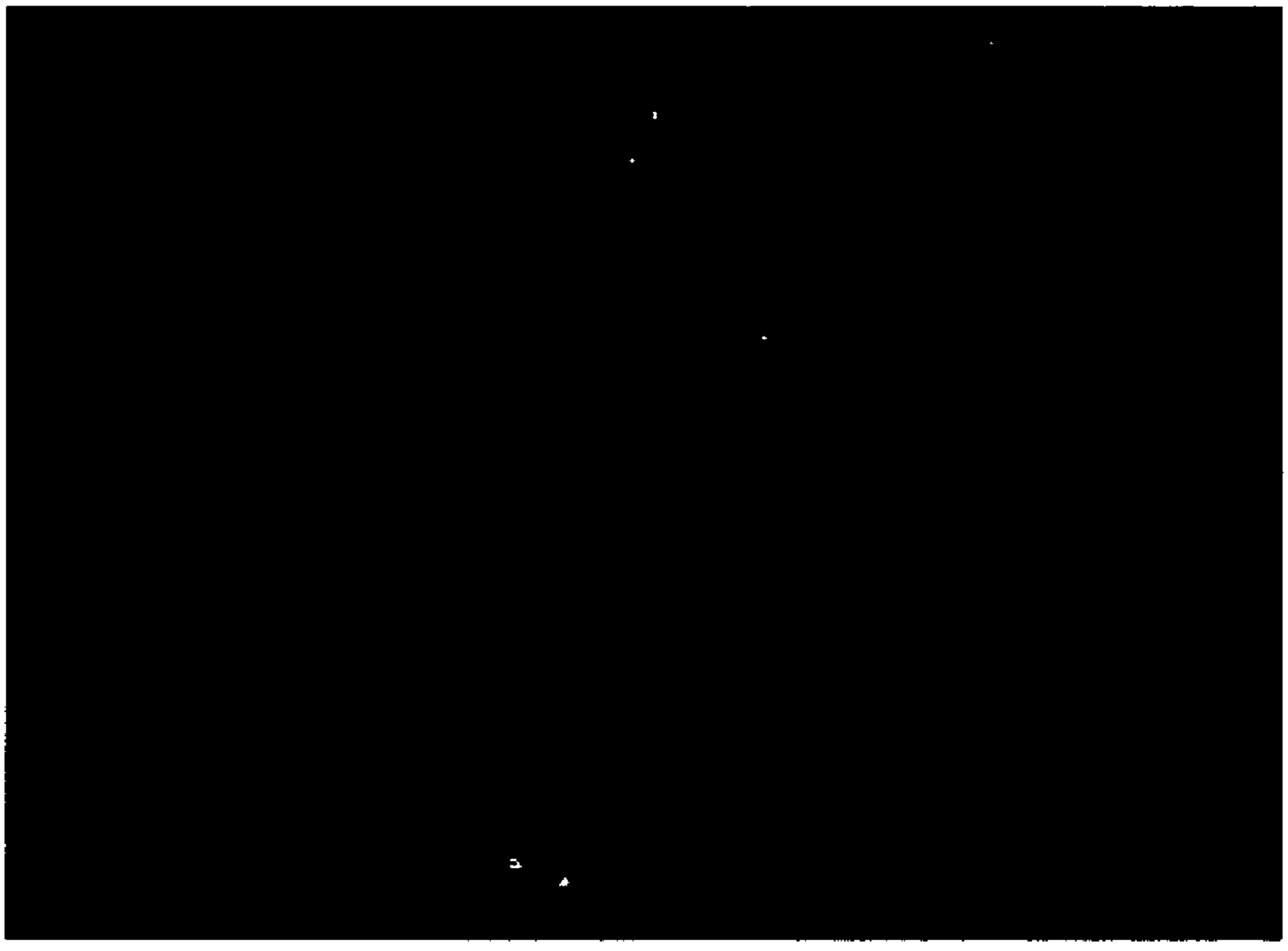


FIG. 1D

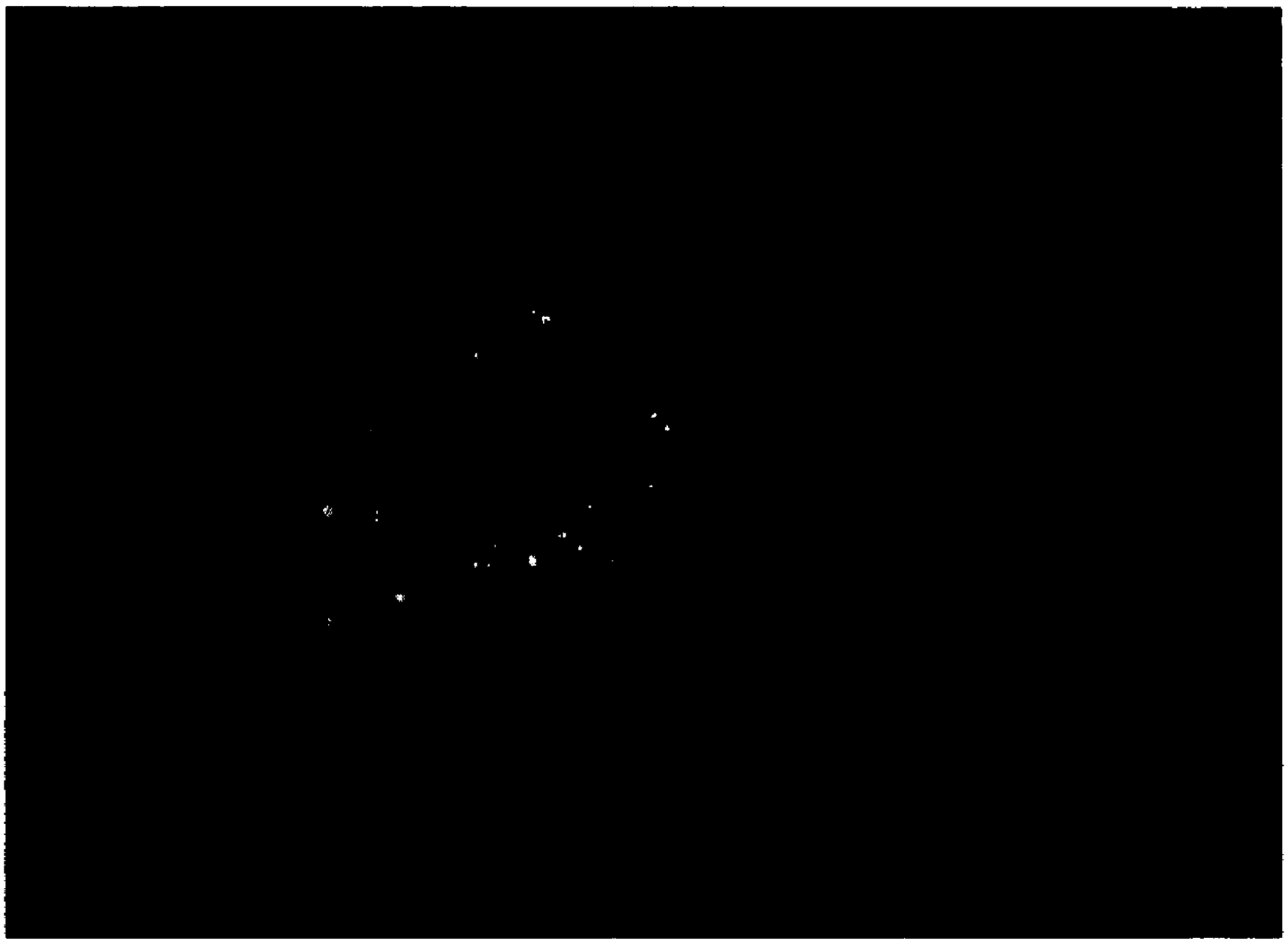


FIG. 1E

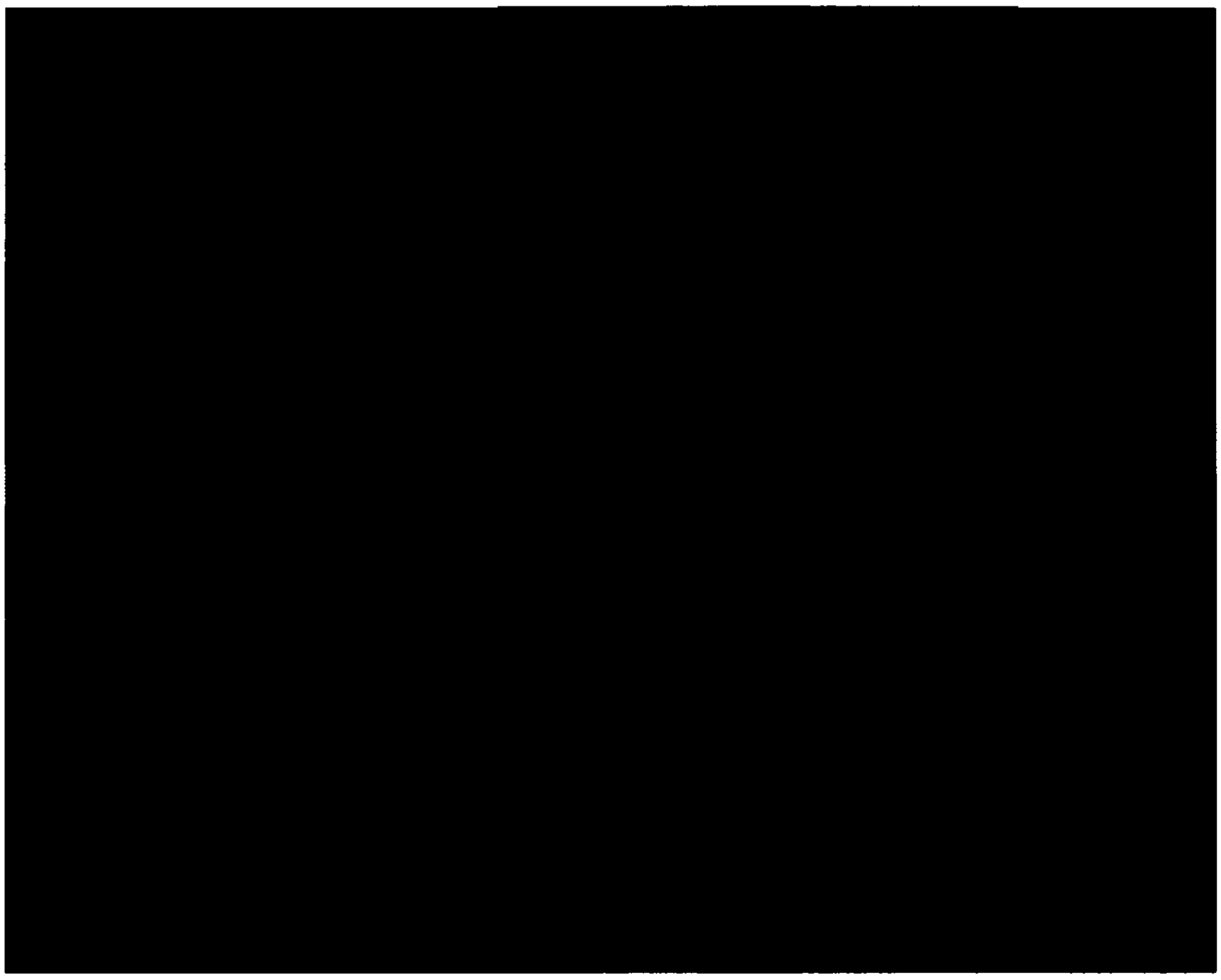


FIG. 1F

FIG. 1G

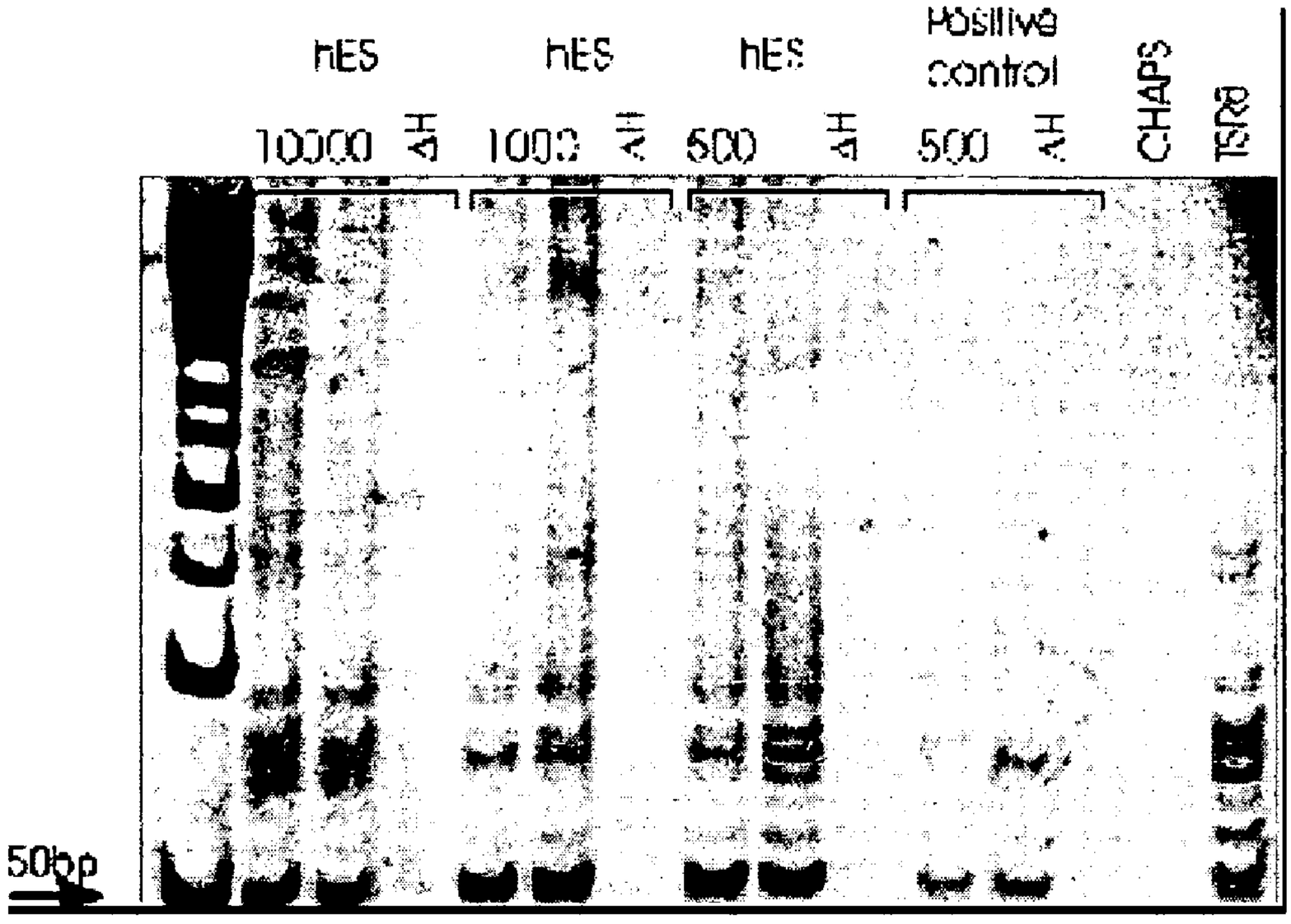

hES
hES
hES
Positive control
CHAPS
TSRB
10000 ng
1000 ng
500 ng
500 ng
50bp

FIG. 2A

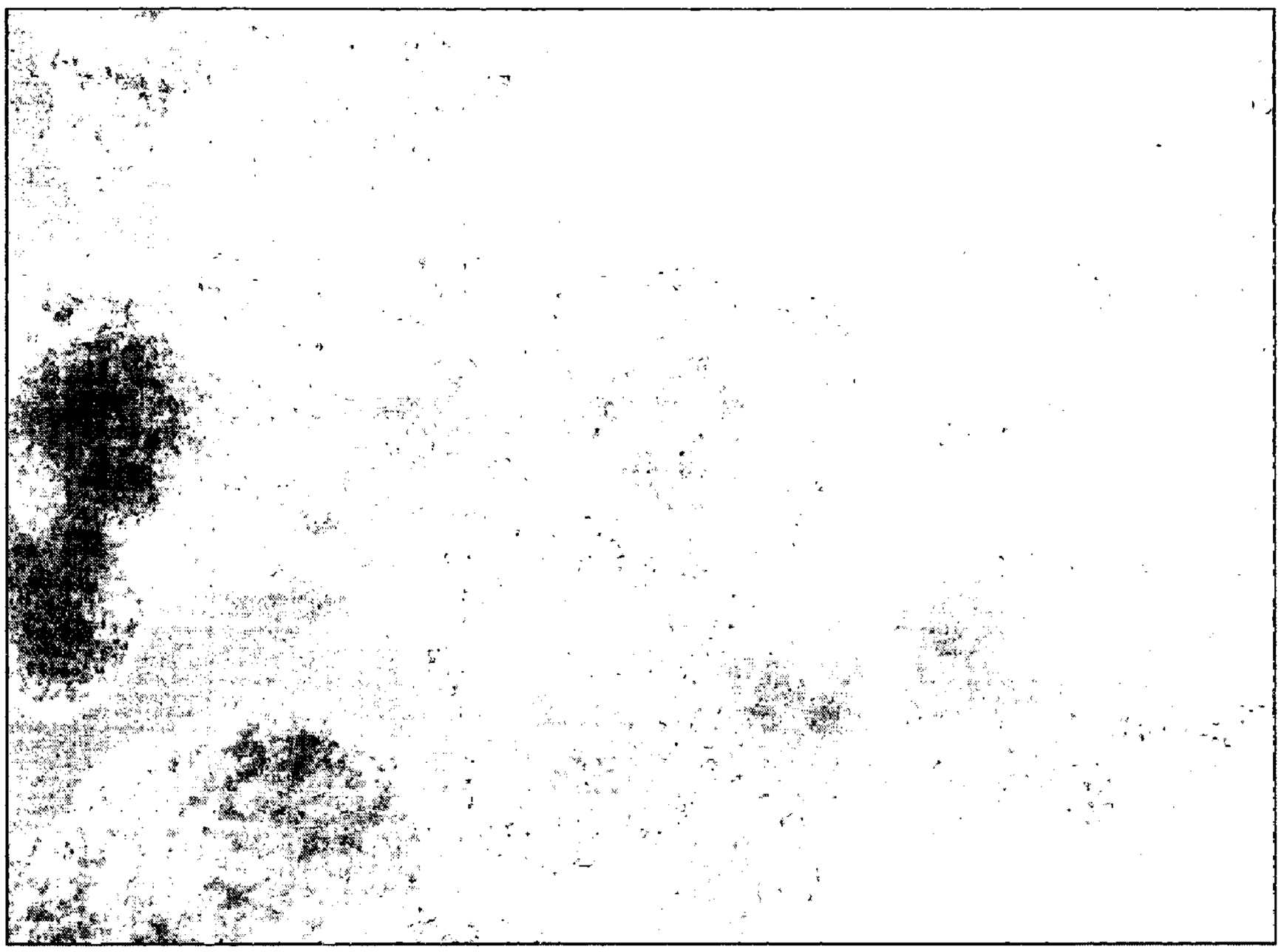


FIG. 2B

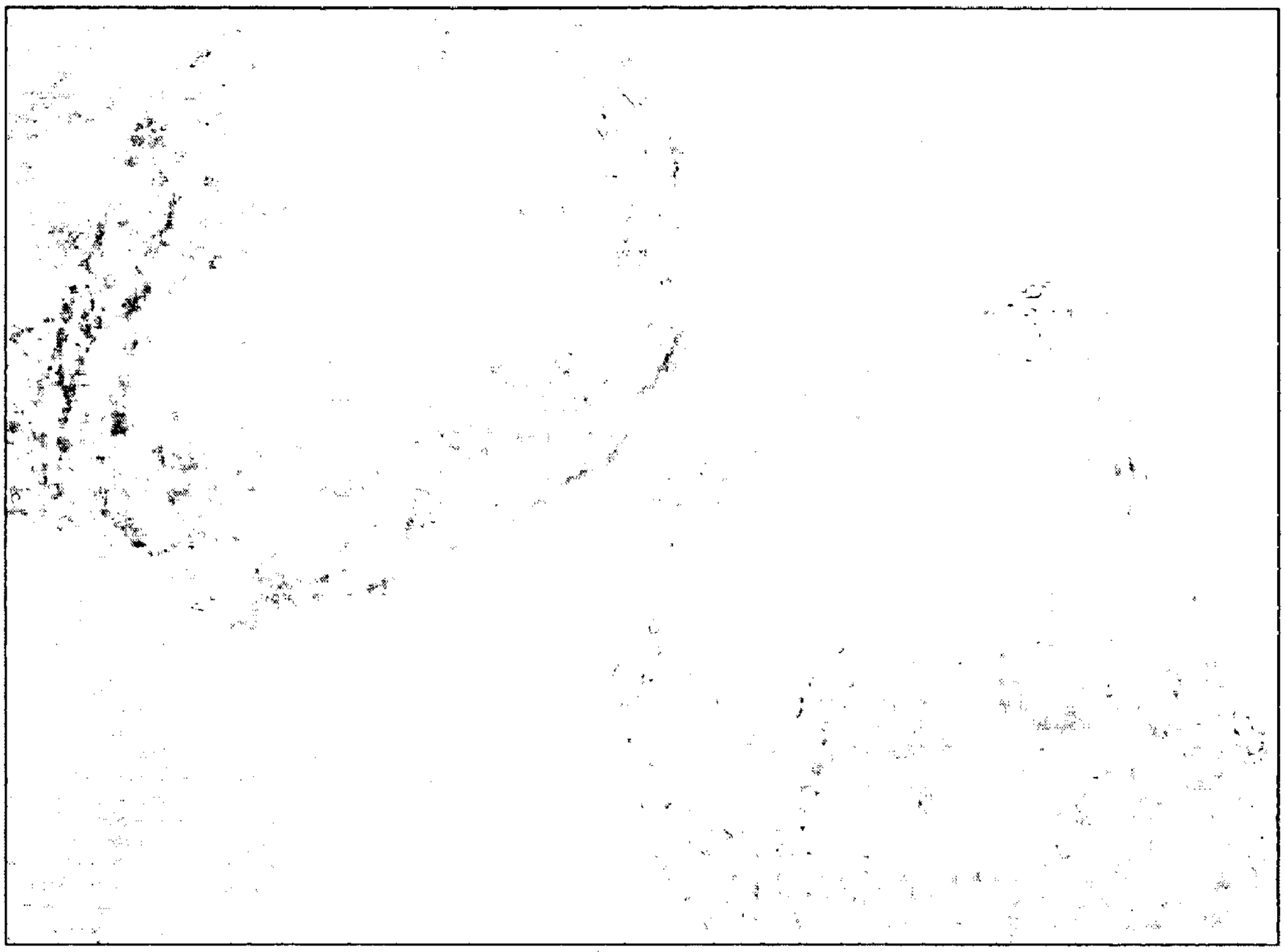


FIG. 2C

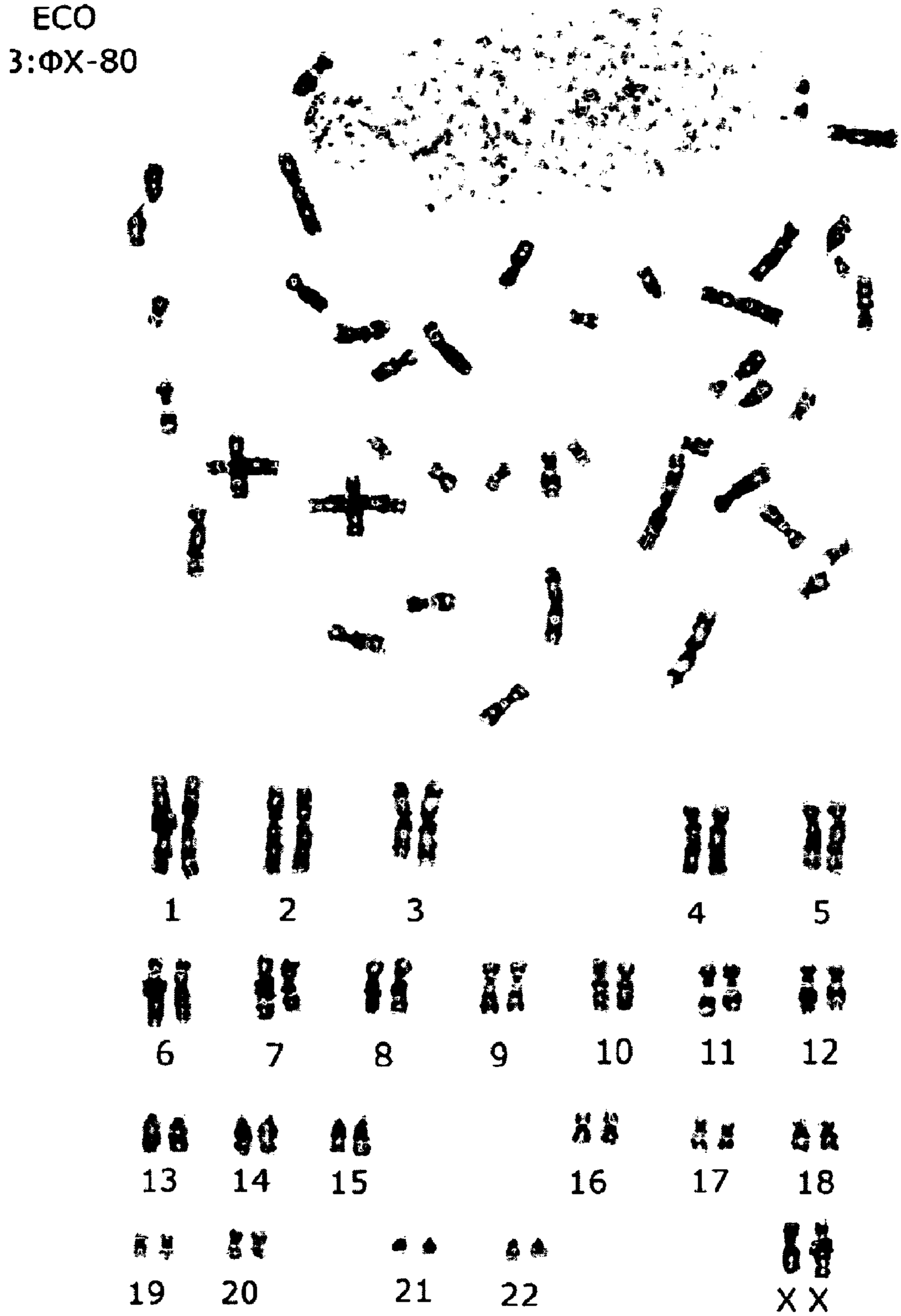


FIG. 2D

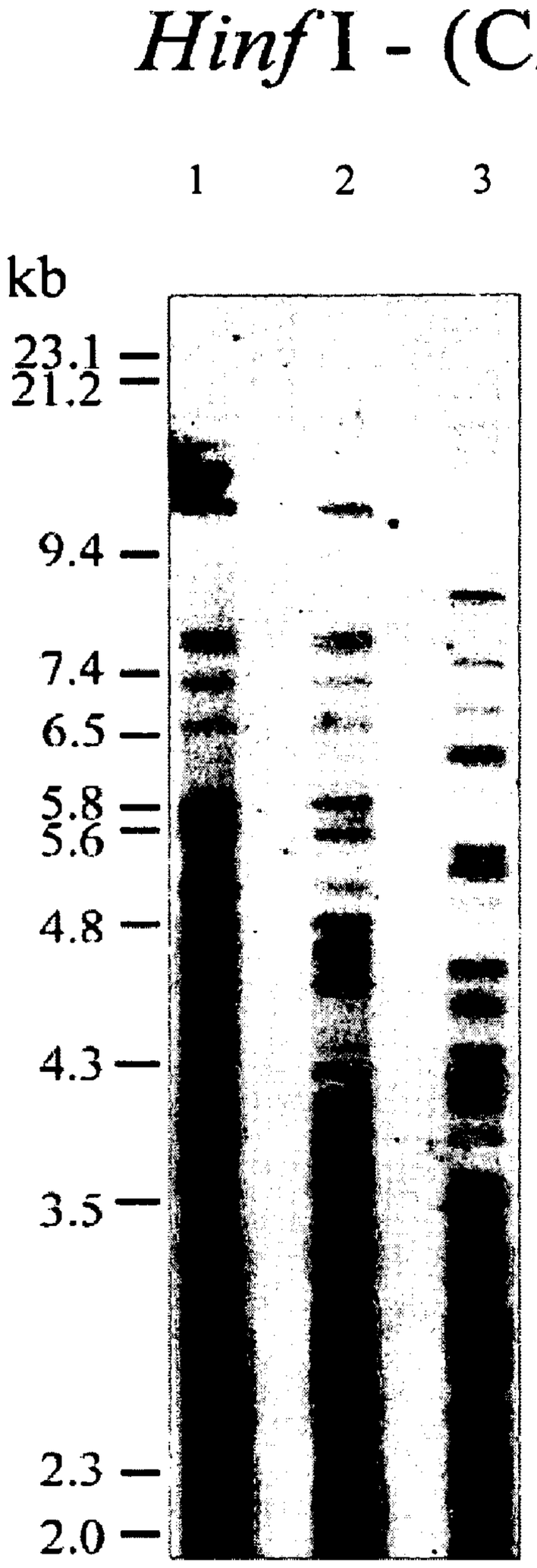


FIG. 2E

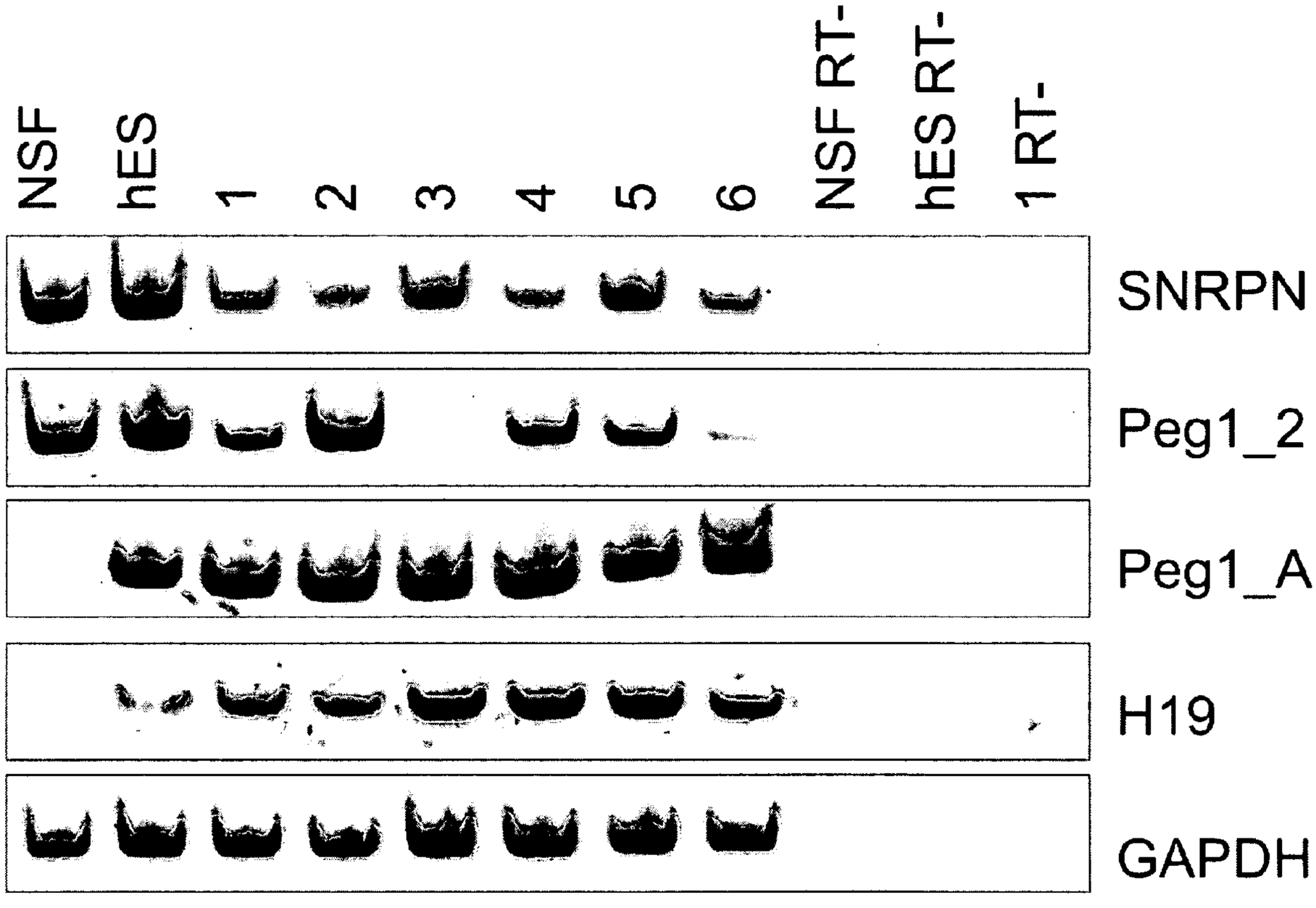


FIG. 3

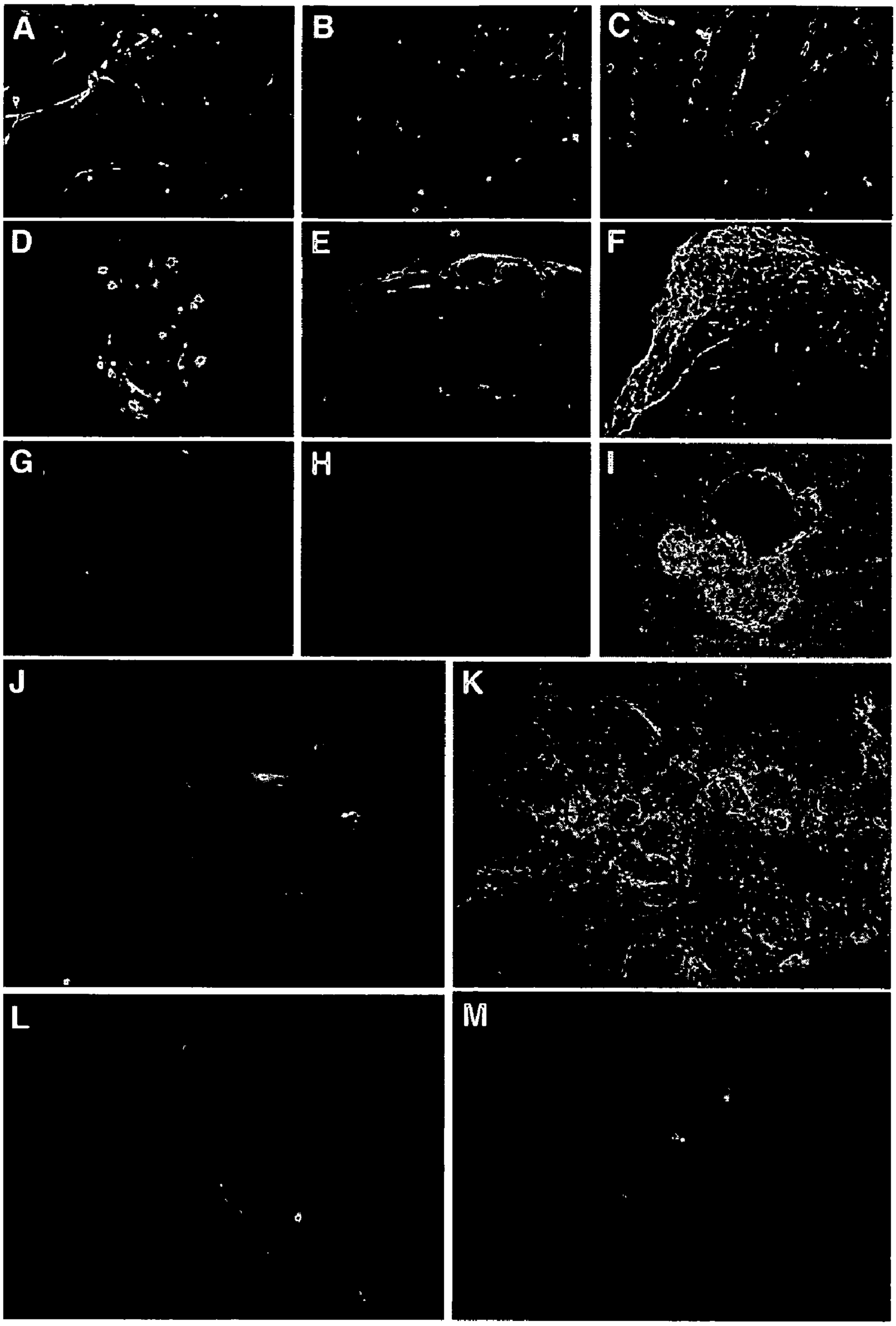


FIG. 4

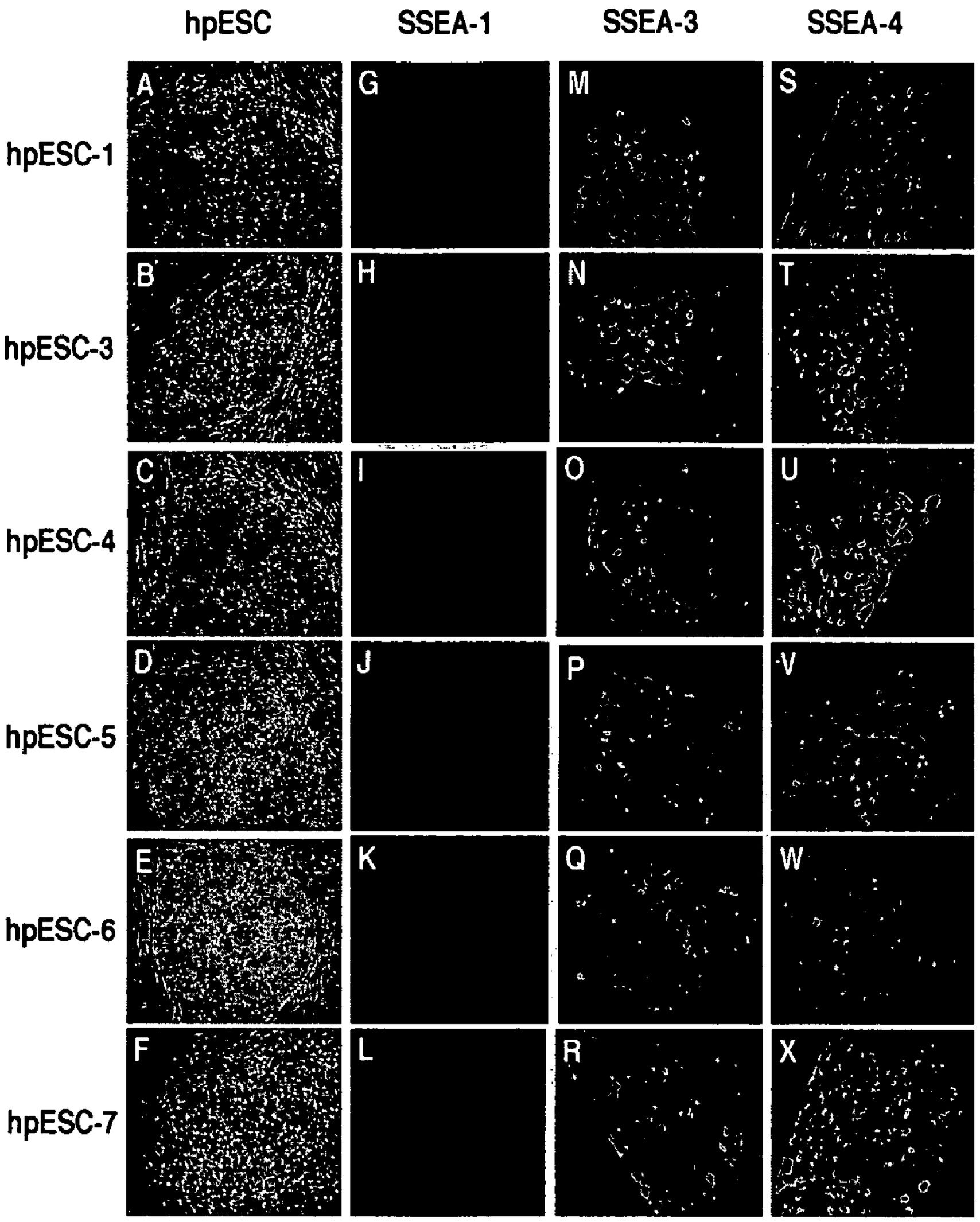

hpESC
SSEA-1
SSEA-3
SSEA-4
hpESC-1
hpESC-3
hpESC-4
hpESC-5
hpESC-6
hpESC-7
A
G
M
S
B
H
N
T
C
I
O
U
D
J
P
V
E
K
Q
W
F
L
R
X

FIG. 5

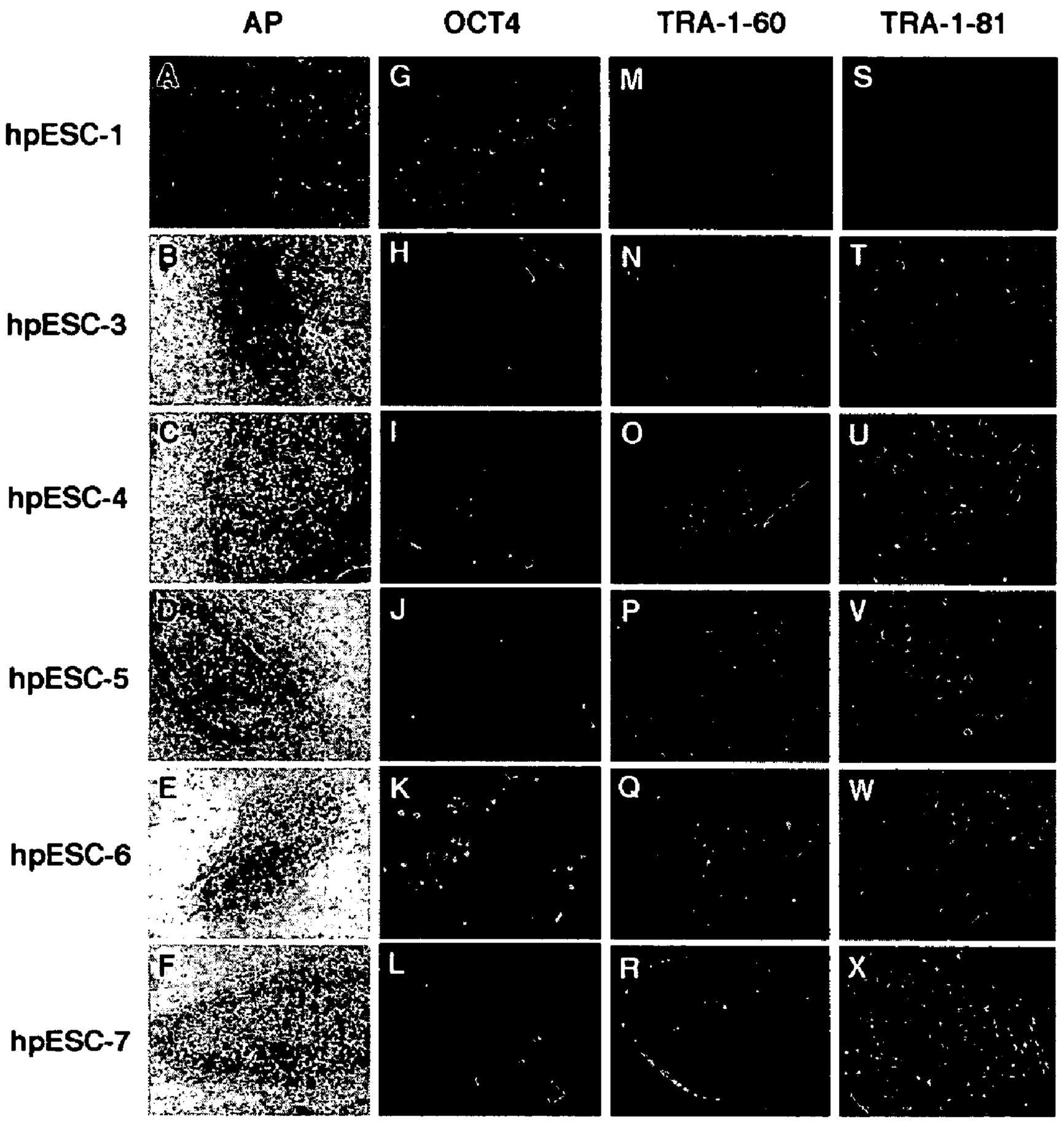

AP
OCT4
TRA-1-60
TRA-1-81
hpESC-1
hpESC-3
hpESC-4
hpESC-5
hpESC-6
hpESC-7
A
G
M
S
B
H
N
T
C
I
O
U
D
J
P
V
E
K
Q
W
F
L
R
X

FIG. 5 (cont'd)

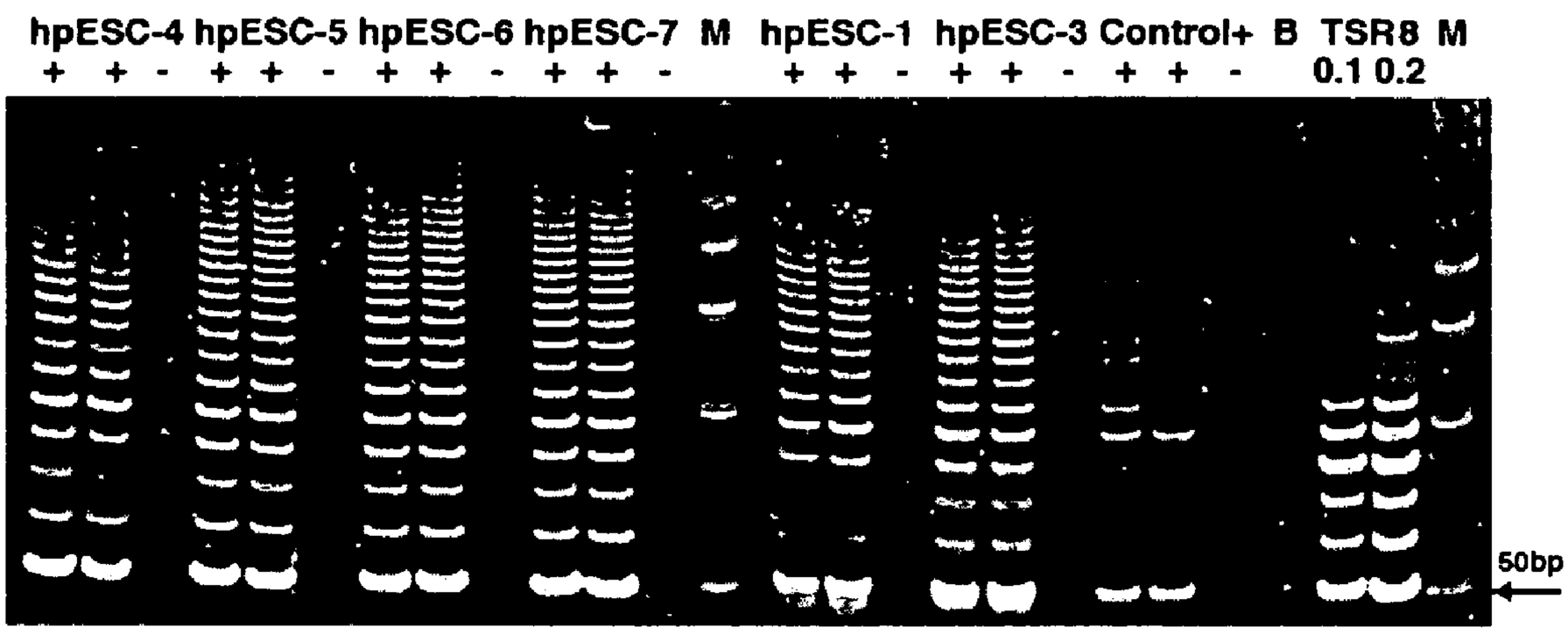
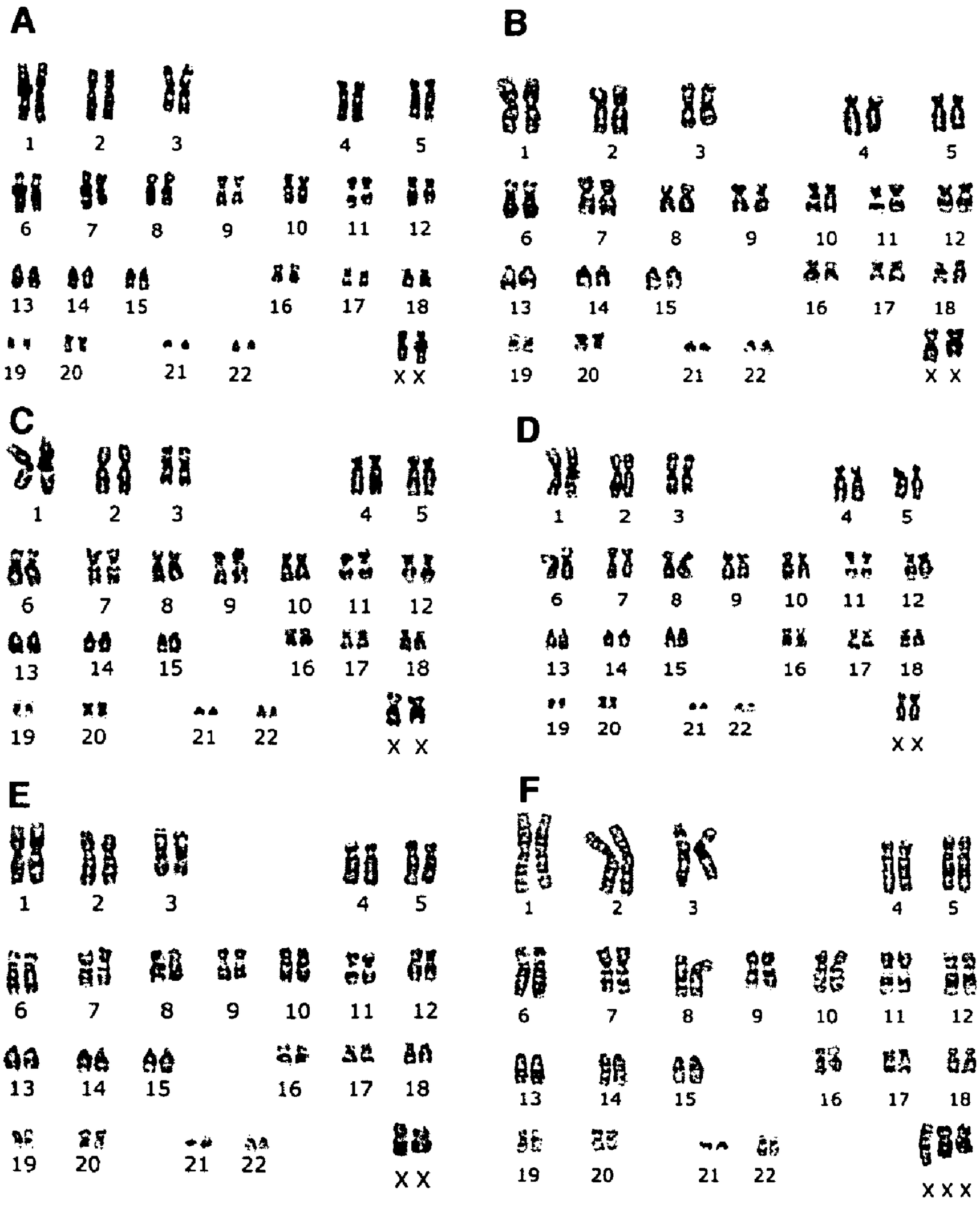

hpESC-4 hpESC-5 hpESC-6 hpESC-7 M hpESC-1 hpESC-3 Control+ B TSR8 M
+ + - + + - + + - + + - + + - + + - + + - 0.1 0.2
50bp

FIG. 6


A
1 2 3 4 5
6 7 8 9 10 11 12
13 14 15 16 17 18
19 20 21 22 X X
B
1 2 3 4 5
6 7 8 9 10 11 12
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19 20 21 22 X X
C
1 2 3 4 5
6 7 8 9 10 11 12
13 14 15 16 17 18
19 20 21 22 X X
D
1 2 3 4 5
6 7 8 9 10 11 12
13 14 15 16 17 18
19 20 21 22 X X
E
1 2 3 4 5
6 7 8 9 10 11 12
13 14 15 16 17 18
19 20 21 22 X X
F
1 2 3 4 5
6 7 8 9 10 11 12
13 14 15 16 17 18
19 20 21 22 X X X

FIG. 7

OXYGEN TENSION FOR THE PARTHENOGENIC ACTIVATION OF HUMAN OOCYTES FOR THE PRODUCTION OF HUMAN EMBRYONIC STEM CELLS

RELATED APPLICATIONS

This application claims benefit of U.S. Provisional Application No. 60/733,309, filed Nov. 2, 2005; U.S. Provisional Application No. 60/758,443, filed Jan. 11, 2006, U.S. Provisional Application No. 60/813,799, filed Jun. 14, 2006, and U.S. Provisional Application No. 60/729,177, filed Oct. 21, 2005, all of which are herein incorporated by reference in their entirety.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to embryonic stems cells, and more specifically to a process for obtaining human embryonic stem cells using parthenogenically activated oocytes.

2. Background Information

Human embryonic stem cells (ES) cells are pluripotent cells that can differentiate into a large array of cell types. When injected into immune-deficient mice, embryonic stem cells form differentiated tumors (teratomas). However, embryonic stem cells that are induced in vitro to form embryoid bodies (EBs) provide a source of embryonic stem cell lines that are amenable to differentiation into multiple cell types characteristic of several tissues under certain growth conditions. For example, ES cells become differentiated into neurons in the presence of nerve growth factor and retinoic acid.

Human ES cells and their differentiated progeny are important sources of normal human cells for therapeutic transplantation and for drug testing and development. Required by both of these goals is the provision of sufficient cells that are differentiated into tissue types suitable for a patient's needs or the appropriate pharmacological test. Associated with this is a need for an efficient and reliable method of producing differentiated cells from embryonic stem cells.

Currently, human embryonic stem cells (hES) are derived from three sources: blastocysts remaining after infertility treatments and donated for research, blastocysts generated from donated gametes (oocytes and sperm), and the products of nuclear transfer (NT). Cadaveric fetal tissue is the only source of human embryonic germ cells (hEG). hES and hEG cells offer remarkable scientific and therapeutic possibilities, involving potential for generating more specialized cells or tissues. Ethical concerns about the sources of hES and hEG cells, however, and fears that use of NT for research could lead to use of NT to produce a human being, have fostered a great deal of public discussion and debate.

Parthenogenic activation of mammalian oocytes may be used as an alternative to fertilization by sperm/NT to prepare oocytes for embryonic stem cell generation. Parthenogenic activation is the production of embryonic cells, with or without eventual development into an adult, from a female gamete in the absence of any contribution from a male gamete.

Parthenogenetic activation of mammalian oocytes has been induced in a number of ways. Using an electrical stimulus to induce activation is of particular interest because electrofusion is part of the current nuclear transfer procedure. Parthenogenetic activation in vitro by electrical stimulation with electrofusion apparatus used for embryonic cell-oocyte membrane fusion has been reported.

Mouse oocytes have been activated by exposure to Ca^{+2}—Mg^{+2} free medium, medium containing hyaluronidase, exposure to ethanol, Ca^{+2} ionophores or chelators, inhibitors of protein synthesis, and electrical stimulation. These procedures have led to high rates of parthenogenic activation and development of mouse oocytes, but did not activate and/or lead to a lower development rate of young bovine oocytes. Further, fertilization and parthenogenic activation of mouse oocytes is also dependent on post ovulatory aging.

Activation of bovine oocytes has been reported by ethanol, electrical stimulation, exposure to room temperature, and a combination of electrical stimulation and protein inhibition with cycloheximide. While these processes are thought to raise intracellular Ca^{+2}, they are most successful when the oocytes have been aged for more than 28 hours.

SUMMARY OF THE INVENTION

The present invention is based on the seminal discovery that certain conditions are optimal for parthenogenically activating human oocytes.

In one embodiment, a method of producing human stem cells is provided including parthenogenetically activating an oocyte, where activation includes contacting the oocyte with an ionophore at high oxygen (O_2) tension and contacting the oocyte with a serine-threonine kinase inhibitor under low O_2 tension, cultivating the activated oocyte at low O_2 tension until blastocyst formation, transferring the blastocyst to a layer of feeder cells, and culturing the transferred blastocyst under high O_2 tension, mechanically isolating an inner cell mass (ICM) from trophectoderm of the blastocyst, and culturing the cells of the ICM on a layer of feeder cells, where culturing the ICM cells is carried out under high O_2 tension. Preferably, the oocyte is human.

In a related aspect, low O_2 tension is maintained by incubation in a gas mixture environment comprising an O_2 concentration of about 2% O_2 to about 5% O_2, where the gas mixture environment further comprises about 5% CO_2 and about 90% nitrogen (N_2) to 93% N_2.

In another embodiment, a method of activating human metaphase II oocytes is provided including incubating human metaphase II oocytes in in vitro fertilization (IVF) media under high O_2 tension, activating by incubating the cells in IVF media comprising an ionophore under high O_2 tension, and subsequently incubating the cells in IVF media comprising a serine-threonine kinase inhibitor (STKI) under low O_2 tension, and incubating the STKI treated cells until blastocyst formation under low O_2 tension, where inner cell masses (ICM) obtained from the blastocyst produce culturable stem cells. High O_2 tension may be maintained by incubating the cells in a gas mixture environment having about 5% CO_2, about 20% O_2, and about 75% N_2.

In a related aspect, the O_2 tension for the incubating steps subsequent to activation is maintained by incubating the cells in a gas mixture environment comprising an O_2 concentration of about 2% O_2 to about 5% O_2, where the gas mixture environment further includes about 5% CO_2 and about 90% N_2 to about 93% N_2.

In another related aspect, the IVF media is essentially free of non-human products.

In a further related aspect, isolated oocytes prepared by the invention methods are provided, including isolated inner cell masses (ICM) prepared from such oocytes and corresponding stem cells isolated therefrom.

In another embodiment, human parthenogenic activation of mammalian oocytes resulting in embryogenic stem cells and their differentiated progeny is provided. Such cells and

progeny are substantially isogenic to the oocyte donor, thus allowing for autologous transplantation of cells relative to the oocyte donor, and rejection by the oocyte donor's immune system is typically avoided.

In a related aspect, a cell bank of hES cell lines derived from parthenogenically activated oocytes is provided.

In one embodiment, a method for producing human stem cells from a cryopreserved oocyte or parthenote is provided, including microinjecting into the cytoplasm of the oocyte or parthenote a cryopreservation agent, freezing the oocyte or parthenote to a cryogenic temperature to cause it to enter a dormant state, storing the oocyte or parthenote in the dormant state, thawing the oocyte or parthenote, parthenogenically activating the oocyte, where the activation includes contacting the oocyte with an ionophore at high O_2 tension and contacting the oocyte with a serine-threonine kinase inhibitor under low O_2 tension, cultivating the parthenote or activated oocyte under low O_2 tension until blastocyst formation, isolating an inner cell mass (ICM) from the trophectoderm of the blastocyst, and culturing the cells of the ICM on a layer of feeder cells, where culturing is carried out under high O_2 tension.

In another embodiment, autologous stem cells derived from parthenogenetically activated oocytes from a human donor are provided. In one aspect, the stem cells possess a substantially identical haplotype as the donor cell. In a related aspect, stem cells are substantially identical genetically to the donor cell.

In one aspect, a stem cell is identified as a full sibling of the donor according to single nucleotide polymorphism (SNP) markers. In another aspect, a stem cell is genomically imprinted according to donor origin.

In one embodiment, a differentiated cell derived from a stem cell obtained from a parthenogenetically activated oocyte from a human donor is disclosed. In a related aspect, the differentiated cell includes, but is not limited to, a neuronal cell, a cardiac cell, a smooth muscle cell, a striated muscle cell, an endothelial cell, an osteoblast, an oligodendrocyte, a hematopoietic cell, an adipose cell, a stromal cell, a chondrocyte, an astrocyte, a dendritic cell, a keratinocyte, a pancreatic islet, a lymphoid precursor cell, a mast cell, a mesodermal cell, and an endodermal cell. In a further related aspect, the differentiated cell expresses one or more markers, including but not limited to, neurofiliment 68, NCAM, beta III-tubulin, GFAP, alpha-actinin, desmin, PECAM-1, VE-Cadherin, alpha-fetoprotein, or a combination thereof.

In another embodiment, a cell line comprising autologous stem cells is disclosed, where the stem cells are derived from parthenogenetically activated oocytes from a human donor. In one aspect, the cells do not express SSEA-1. In another aspect, the cells of the cell line give rise to ectodermal, mesodermal, and endodermal germ lines.

In one embodiment, a cell bank is disclosed including cryopreserved parthenotes, where the parthenotes are derived from parthenogenetically activated oocytes from one or more human donors. In a related aspect, the parthenotes have been cultivated under low O_2 tension until blastocyst formation.

In one embodiment, a cell bank is disclosed including cryopreserved autologous stem cells, where the stem cells are derived from parthenogenetically activated oocytes from one or more human donors.

In another embodiment, a method of treating a subject in need thereof, comprising administering a cellular composition comprising differentiated cells, wherein the differentiated cells are derived from a stem cell obtained from a parthenogenetically activated oocyte from a human donor. In one aspect, the differentiated cell is selected from the group consisting of a neuronal cell, cardiac cell, smooth muscle cell, striated muscle cell, endothelial cell, osteoblast, oligodendrocyte, hematopoietic cell, adipose cell, stromal cell, chondrocyte, astrocyte, dendritic cell, keratinocyte, pancreatic islet, lymphoid precursor cell, mast cell, mesodermal cell, and endodermal cell.

In a related aspect, the subject presents a disease selected from the group consisting of Parkinson's disease, Huntington's disease, Alzheimer's disease, ALS, spinal cord defects or injuries, multiple sclerosis, muscular dystrophy, cystic fibrosis, liver disease, diabetes, heart disease, retinal disease (such as macular degeneration and retinitis pigmentosa), cartilage defects or injuries, burns, foot ulcers, vascular disease, urinary tract disease, AIDS, and cancer.

In one embodiment, a method of generating cloned human embryonic stem cells is disclosed, including removing a first pronuclei from a previously fertilized human oocyte, transferring a second pro-nuclei into the enucleated oocyte, where the second pro-nuclei is derived from a donor oocyte or an oocyte from the mother of the donor, or a parthenogenetically activated oocyte, where the pro-nuclei of the oocyte has been replaced by the nucleus of a donor somatic cell prior to activation, and cultivating the resulting oocyte until blastocyst formation, where an inner cell mass from the blastocyst contains the embryonic stem cells.

Exemplary methods and compositions according to this invention are described in greater detail below.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1**A shows a micrograph of the surface marker expression of alkaline phosphatase for the parthenogenically derived hES cells.

FIG. **1**B shows a micrograph of the expression for the surface marker Oct4.

FIG. **1**C shows a micrograph of the expression for the surface marker SSEA-1.

FIG. **1**D shows a micrograph of the expression for the surface marker SSEA-3.

FIG. **1**E shows a micrograph of the expression for the surface marker SSEA-4.

FIG. **1**F shows a micrograph of the expression for the surface marker TRA-1-60.

FIG. **1**G shows a micrograph of the expression for the surface marker TRA-1-81.

FIG. **2**A shows the analysis of telomerase activity for the parthenogenically derived hES cells. 500, 1000, and 10000 (units) of extract was used to perform the analysis. ΔH-heat treated test extract (negative control); positive control-telomerase positive cells; CHAPS-lysis buffer; TSR8-control template.

FIG. **2**B shows a micrograph of embryoid body formation from parthenogenically derived hES cells, 9 day culture.

FIG. **2**C shows a micrograph of embryoid body formation from parthenogenically derived hES cells, 10 day culture.

FIG. **2**D illustrates the karyotype of parthenogenically derived hES cells.

FIG. **2**E shows the results from DNA finger printing analysis of parthenogenically derived hES cells. 1—DNA from the blood of the oocyte donor; 2—DNA from the parthenogenic hES cells derived from the same donor; 3—DNA from human feeder fibroblasts.

FIG. **3** shows a Northern blot characterizing the expression of genes associated with genomic imprinting. DNA probes: SNRPN, Peg1__2, Peg1_A, H19, and GAPDH (as an internal control). NSF, neonatal skin fibroblasts; hES, human embryonic stem cell line derived from fertilized oocytes; 1, phESC-

1; 2, phESC-3, 3, phESC-4, 4, phESC-5; 5, phESC-6; 6 phESC-7. NSF RT−, hES RT−, 1 RT− are negative controls.

FIG. **4** shows the differentiation of phESC into derivatives of all three germ layers. Ectoderm differentiation is presented by positive immunocytochemical staining for neuron specific markers 68 (A), NCAM (B), beta III-tubulin (C) and glial cell marker GFAP (D, M). Differentiated cells were positive for mesodermal markers: muscle specific alpha actinin (G) and desmin (J), endothelial markers PECAM-1 (E) and VE-Cadherin (F). Endoderm differentiation is presented by positive staining for alpha-fetoprotein (H, L). The phESC produce pigmented epithelial-like cells (I, K). Magnification (I)×100; (A-H, J-M),×400.

FIG. **5** shows the characterization of phESC lines for specific markers. Undifferentiated colonies of phESC on human feeder layer cells (A-F), negative staining for SSEA-1 (G-L), expression of cell surface markers SSEA-3 (M-R), SSEA-4 (S—X). Magnification (A) to (E)×100; (F)×200; (G) to (X)×400. Alkaline phosphatase positive staining of phESC colonies on feeder cells (A-F), OCT-4 (G-L), TRA-1-60 (K—R) and TRA-1-81 (S—X). Magnification (A, B, O, R)×100; (C—F, M, S, X)×200; (G-L, N, P, Q, T-W)×400.

FIG. **6** demonstrates that phESC cells possess high levels of telomerase activity by comparison with positive control cells: "+"-extract from 500 cells; "−"-heat treated cell extract with inactivated telomerase; "Control +"-telomerase positive cell extract (applied with TRAPEZE Kit); "B"-CHAPS lysis buffer, primer-dimer/PCR contamination control; TSR8-telomerase quantitative control template (0.1 and 0.2 amole/μl); "M"-marker, DNA ladder.

FIG. **7** shows the G-banded karyotyping of phESC lines. The phESC-1 (A), phESC-3 (B), phESC-4 (C), phESC-5 (D) and phESC-6 (E) lines have normal 46, XX karyotype. The phESC-7 line has 47, XXX karyotype (F).

DETAILED DESCRIPTION OF THE INVENTION

Before the present composition, methods, and culturing methodologies are described, it is to be understood that this invention is not limited to particular compositions, methods, and experimental conditions described, as such compositions, methods, and conditions may vary. It is also to be understood that the terminology used herein is for purposes of describing particular embodiments only, and is not intended to be limiting, since the scope of the present invention will be limited only in the appended claims.

As used in this specification and the appended claims, the singular forms "a", "an", and "the" include plural references unless the context clearly dictates otherwise. Thus, for example, references to "the method" includes one or more methods, and/or steps of the type described herein which will become apparent to those persons skilled in the art upon reading this disclosure and so forth.

"Differentiation" refers to a change that occurs in cells to cause those cells to assume certain specialized functions and to lose the ability to change into certain other specialized functional units. Cells capable of differentiation may be any of totipotent, pluripotent or multipotent cells. Differentiation may be partial or complete with respect to mature adult cells.

Gynogenesis refers to the production of an embryo containing a discernible trophectoderm and inner cell mass that results upon activation of a cell, such as an oocyte, or other embryonic cell type, containing mammalian DNA of all female origin, preferably human female origin, e.g., human or non-human primate oocyte DNA. Such female mammalian DNA may be genetically modified, e.g., by insertion, deletion or substitution of at least one DNA sequence, or may be unmodified. For example, the DNA may be modified by the insertion or deletion of desired coding sequences, or sequences that promote or inhibit embryogenesis. Typically, such an embryo will be obtained by in vitro activation of an oocyte that contains DNA of all female origin. Gynogenesis is inclusive of parthenogenesis which is defined below. It also includes activation methods where the spermatozoal DNA does not contribute to the DNA in the activated oocyte.

In a related aspect, oocytes are obtained from superovulating subjects prepared for IVF. "Superovulation" techniques, such as treatment of a female subject with hormones, used in IVF are designed to stimulate the ovaries to produce several eggs (oocytes) rather than the usual single egg as in a natural cycle.

The medications required to boost egg production may include, but are not limited to the following: Lupron (gonadotropin releasing hormone-agonist), Orgalutran, Antagon or Cetrotide (gonadotropin releasing hormone-antagonist), Follistim, Bravelle or Gonal-F (FSH, follicle stimulating hormone), Repronex (combination of FSH and LH, luteinizing hormone), and Pregnyl or Novarel (hCG, human chorionic gonadotropin).

In a related aspect, collection of eggs can be performed under transvaginal ultrasound guidance. To accomplish this, a needle is inserted (e.g., under IV sedation) through the vaginal wall into the ovaries using ultrasound to locate each follicle. The follicular fluid is drawn up into a test tube to obtain the eggs.

"Parthenogenesis" ("parthenogenically activated" and "parthenogenetically activated" is used interchangeably) the process by which activation of the oocyte occurs in the absence of sperm penetration, and refers to the development of an early stage embryo comprising trophectoderm and inner cell mass that is obtained by activation of an oocyte or embryonic cell, e.g., blastomere, comprising DNA of all female origin. In a related aspect, a "parthenote" refers to the resulting cell obtained by such activation. In another related aspect, "blastocyst" refers to a cleavage stage of a fertilized or activated oocyte comprising a hollow ball of cells made of outer trophoblast cells and an inner cell mass (ICM). In a further related aspect, "blastocyst formation" refers to the process, after oocyte fertilization or activation, where the oocyte is subsequently cultured in media for a time to enable it to develop into a hollow ball of cells made of outer trophoblast cells and ICM (e.g., 5 to 6 days).

In one embodiment, the process of creating cloned human embryonic stem cell line by parthenogenetically activated oocytes is disclosed. While pathogenesis is not an uncommon form of reproduction in nature, mammals are not known to be capable of this form of reproduction. However, a 10% rate of spontaneous parthenogenesis can be found in oocytes from females of the inbred mouse strain LT/Sv (Ozil and Huneau, Development (2001) 128:917-928; Vrana et al., Proc Natl Acad Sci USA (2003) 100(Suppl 1):11911-11916; Berkowitz and Goldstein, New Eng J Med (1996) 335(23):1740-1748). Oocytes from placental mammals can be induced to undergo parthenogenesis in vitro; however, embryonic development is unsuccessful.

Following parthenogenic activation of mammalian oocytes and transfer of the activated oocyte into a surrogate mother, there is limited embryonic survival: ten days in mice; 21 days in sheep; 29 days in pigs; and 11.5 days in rabbits (Kurebayashi et al., Theriogenology (2000) 53:1105-1119; Hagemann et al., Mol Reprod Dev (1998) 50:154-162; Surani and Barton, Science (1983) 222:1034-1036). The reason for this arrested development is likely due to genetic imprinting. It has been shown that maternal and paternal genomes are epi-

gentically different and that both sets are required for successful embryonic development (Surani, Cell (1998) 93:309-312; Sasaki et al., (1992) 6:1843-1856). In parthenotes, all of the genetic material should be of maternal origin, a therefore should lack paternal imprinting. Paternal imprinting is thought to be responsible for extra-embryo tissue development, thus the development of trophoblastic tissue following fertilization of an enucleated oocyte (Stevens, Nature (1978) 276:266-267). In animals, therefore, enucleated zygotes may be useful for nuclear transfer with subsequent parthenogenic activation.

In another embodiment, the nucleus from a donor's somatic cell can be transferred into a fertilized enucleated human oocyte with subsequent parthenogenetic activation. The three embodiments above are illustrated by the following flow diagrams:

Case 1				
Female patient →	Remove oocyte →	Parthenogenetic → activation	Remove → pronuclei	Add pronuclei to enucleated fertilized oocyte
Male patient →	Obtain oocyte from → patient's mother	Parthenogenetic → activation	Remove → pronuclei	Add pronuclei to enucleated fertilized oocyte
Case 2				
Obtain donor → oocyte	Remove → pronuclei	Add nucleus from → patient's somatic cell using nuclear transfer	Parthenogenetic → activation	Remove → pronuclei	Add pronuclei to enucleated fertilized oocyte
Case 3				
Obtain donor oocyte →	Fertilize →	Remove nucleus →	Add patient's → somatic cell nucleus	Parthenogenetic activation

Mammalian parthenotes undergo only limited development with eventual death of the embryo. In Macac fascicularis, only 14 percent of oocytes in stage II metaphase following in vitro Parthenogenetic activation developed to the blastocyst stage following 8 days of culture (Monk, Genes Dev (1988) 2:921-925). Similarly, 12 percent of human oocytes that were parthenogenetically activated in vitro following nuclear transfer developed to the blastocyst state (Monk, 1988). In both cases, one stem cell line was created.

Embryos formed in spontaneously activated parthenotes in virgin females of the LT/Sv inbred mouse strain die within a few days. When nuclear transfer is performed from cells comprising the inner cell mass (ICM) of these embryos into fertilized enucleated C57BL/6j mouse oocytes, cloned mice with the LT/Sv genome are obtained (Kaufman et al., Nature (1977) 265:53-55). Thus, the use of a fertilized oocyte allows for full-term development of a parthenote. In one aspect, a fertilized enucleated human oocyte can be used to support development of a parthenogenetic embryo containing a donor's nuclei until the blastocyst stage.

In one embodiment, the pronuclei of a donor's oocyte or from the oocyte of the mother of a donor, following parthenogenetic activation, can be transferred into a fertilized human oocyte from which the male and female pronuclei have been extracted.

In another embodiment, a two stage process is disclosed for generating human stem cells including transferring the nucleus of a donor's somatic cell into a donor oocyte, where the oocyte is subsequently activated by parthenogenesis and transferring the pronuclei of the activated oocyte into a fertilized oocyte, where the male and female pronuclei have been extracted.

"Pluripotent cell" refers to a cell derived from an embryo produced by activation of a cell containing DNA of all female or male origin that can be maintained in vitro for prolonged, theoretically indefinite period of time in an undifferentiated state, that can give rise to different differentiated tissue types, i.e., ectoderm, mesoderm, and endoderm. The pluripotent state of the cells is preferably maintained by culturing inner cell mass or cells derived from the inner cell mass of an embryo produced by androgenetic or gynogenetic methods under appropriate conditions, for example, by culturing on a fibroblast feeder layer or another feeder layer or culture that includes leukemia inhibitory factor (LIF). The pluripotent state of such cultured cells can be confirmed by various methods, e.g., (i) confirming the expression of markers characteristic of pluripotent cells; (ii) production of chimeric animals that contain cells that express the genotype of the pluripotent cells; (iii) injection of cells into animals, e.g., SCID mice, with the production of different differentiated cell types in vivo; and (iv) observation of the differentiation of the cells (e.g., when cultured in the absence of feeder layer or LIF) into embryoid bodies and other differentiated cell types in vitro.

"Diploid cell" refers to a cell, e.g., an oocyte or blastomere, having a diploid DNA content of all male or female origin.

"Haploid cell" refers to a cell, e.g., an oocyte or blastomere, having a haploid DNA content, where the haploid DNA is of all male or female origin.

Activation refers to a process where a fertilized or unfertilized oocyte, for example, but not limited to, in metaphase II of meiosis, undergoes a process typically including separation of the chromatid pairs, extrusion of the second polar body, resulting in an oocyte having a haploid number of chromosomes, each with one chromatid. Activation includes methods whereby a cell containing DNA of all male or female origin is induced to develop into an embryo that has a discernible inner cell mass and trophectoderm, which is useful for producing pluripotent cells but which is itself is likely to be incapable of developing into a viable offspring. Activation may be carried out, for example, under one of the following conditions: (1) conditions that do not cause second polar body extrusion; (ii) conditions that cause polar body extrusion but where the polar body extrusion is inhibited; or (iii) conditions that inhibit first cell division of the haploid oocyte.

"Metaphase II" refers to a stage of cell development where the DNA content of a cell consists of a haploid number of chromosomes with each chromosome represented by two chromatids.

In one embodiment, metaphase II oocytes are activated by incubating oocytes under various O_2 tension gas environments. In a related aspect, the low O_2 tension gas environment is created by a gas mixture comprising an O_2 concentration of about 2%, 3%, 4%, or 5%. In a further related aspect, the gas mixture comprises about 5% CO_2. Further, the gas mixture comprises about 90% N_2, 91% N_2, or 93% N_2. This gas mixture is to be distinguished from 5% CO_2 air, which is approximately about 5% CO_2, 20% O_2, and 75% N_2.

"O_2 tension" refers to the partial pressure (pressure exerted by a single component of a gas mixture) of oxygen in a fluid (i.e., liquid or gas). Low tension is when the partial pressure of oxygen (pO_2) is low and high tension is when the pO_2 is high.

"Defined-medium conditions" refer to environments for culturing cells where the concentration of components therein required for optimal growth are detailed. For example, depending on the use of the cells (e.g., therapeutic applications), removing cells from conditions that contain xenogenic proteins is important; i.e., the culture conditions are animal-free conditions or free of non-human animal proteins. In a related aspect, "in vitro fertilization (IVF) media" refers to a nutrient system which contains chemically defined substances on or in which fertilized oocytes can be grown.

"Extracellular matrix (ECM) substrates" refer to a surface beneath cells which supports optimum growth. For example, such ECM substrates include, but are not limited to, Matrigel, laminin, gelatin, and fibronectin substrates. In a related aspect, such substrates may comprise collagen IV, entactin, heparin sulfate proteoglycan, to include various growth factors (e.g., bFGF, epidermal growth factor, insulin-like growth factor-1, platelet derived growth factor, nerve growth factor, and TGF-β-1).

"Embryo" refers to an embryo that results upon activation of a cell, e.g., oocyte or other embryonic cells containing DNA of all male or female origin, which optionally may be modified, that comprises a discernible trophectoderm and inner cell mass, which cannot give rise to a viable offspring and where the DNA is of all male or female origin. The inner cell mass or cells contained therein are useful for the production of pluripotent cells as defined previously.

"Inner cell mass (ICM)" refers to the inner portion of an embryo which gives rise to fetal tissues. Herein, these cells are used to provide a continuous source of pluripotent cells in vitro. Further, the ICM includes the inner portion of the embryo that results from androgenesis or gynogenesis, i.e., embryos that result upon activation of cells containing DNA of all male or female origin. Such DNA, for example, will be human DNA, e.g., human oocyte or spermatozoal DNA, which may or may not have been genetically modified.

"Trophectoderm" refers to another portion of early stage embryo which gives rise to placental tissues, including that tissue of an embryo that results from androgenesis or gynogenesis, i.e., embryos that result from activation of cells that contain DNA of all male or female origin, e.g., human ovarian or spermatozoan.

"Differentiated cell" refers to a non-embryonic cell that possesses a particular differentiated, i.e., non-embryonic, state. The three earliest differentiated cell types are endoderm, mesoderm, and ectoderm.

"Substantially identical" refers to a quality of sameness regarding a particular characteristic that is so close as to be essentially the same within the ability to measure difference (e.g., by HLA typing, SNP analysis, and the like).

"Histocompatible" refers to the extent to which an organism will tolerate a graft of a foreign tissue.

"Genomic imprinting" refers to the mechanism by which a number of genes throughout the genome are monoallelically expressed according to their parental origin.

"Homoplasmy," including grammatical variations thereof, refers to the presence of the same type of the mitochondrial DNA (mtDNA) within a cell or individual.

"Heteroplasmy," including grammatical variations thereof, refers to the presence of a mixture of more than one type of mitochondrial DNA (mtDNA) within a cell or individual.

"Uniparental" refers to one or more cells or individuals from which another arises and to which it remains subsidiary.

"Mechanically isolating" refers to the process of separating cell aggregates by physical forces. For example, such a process would exclude the use of enzymes (or other cell cleavage products) which might contain non-human materials.

In the native environment, immature oocytes (eggs) from the ovary undergo a process of maturation which results in the progression through meiosis to metaphase II of meiosis. The oocytes then arrest at metaphase II. In metaphase II, the DNA content of the cell consists of a haploid number of chromosomes, each represented by two chromatids.

Such oocytes may be maintained indefinitely by cryopreserving by, for example, but not limited to, microinjection with a sugar.

In one embodiment, a method for producing human stem cells from a cryopreserved oocyte or parthenote is provided, including microinjecting into the cytoplasm of the oocyte or parthenote a cryopreservation agent, freezing the oocyte or parthenote to a cryogenic temperature to cause it to enter a dormant state, storing the oocyte or parthenote in the dormant state, thawing the oocyte or parthenote, parthenogenically activating the oocyte under high O_2 tension in the presence or an ionophore followed by contacting the oocyte with a serine-threonine kinase inhibitor under low O_2 tension, culturing the activated oocyte or parthenote until blastocyst formation, isolating an inner cell mass (ICM) from the blastocyst, and culturing the cells of the ICM on a layer of human feeder cells, where culturing the ICM cells is carried out under high O_2 tension.

In one aspect, oocytes obtained as described are transferred to modified, isotonic IVF covered with embryo-tested mineral oil (Sigma), or any other suitable medium. If desired, the oocytes may be incubated with an extracellular sugar at the same concentration as the amount planned for microinjection. For example, to inject 0.1 M sugar, oocytes may be equilibrated in DMEM/F-12 with 0.1 M sugar. In one aspect, the cryopreservation agent comprises a lower Na^+ concentration than standard DMEM (i.e., Na^+ low media). In a related aspect, the cryopreservation agent comprises a higher K^+ concentration than standard DMEM (i.e., K^+ high). In a further related aspect, the cryopreservation agent comprises both a lower Na^+ and higher K^+ concentration than standard DMEM (i.e., Na^+ low/K^+ high media). In one aspect, the cryopreservation agent comprises an organic buffer, including but not limited to, HEPES. In another aspect, the cryopreservation agent comprises moieties that inhibit apoptotic protein (e.g., capases).

Alternatively, the oocytes may be optionally equilibrated with any other substantially non-permeable solute, such a NaCl, to decrease their cell volume prior to microinjection. This initial decrease in cell volume may result in a smaller final volume of the microinjected oocytes compared to

oocytes not incubated in a hypertonic media prior to microinjection. This smaller final volume may minimize any potential adverse effect from the swelling of the oocytes. This general procedure for the preparation of cells for microinjection may also be used for other cell types (e.g., activated oocytes, hES cells, and the like).

The oocytes are then microinjected with a cryopreservation agent. Microinjection equipment and procedures are well characterized in the art and microinjection equipment known for use in injecting small molecules into cells may be used with the invention. In an exemplary microinjection step, oocytes can be microinjected at a pressure of 10 psi for 30 milliseconds. Another example of a standard microinjection technique is the method described by Nakayama and Yanagimachi (Nature Biotech. 16:639-642, 1998).

A cryopreservation agent useful in this process includes any chemical that has cryo-protective properties and is ordinarily non-permeable. In particular, the cryopreservation agent can include sugars either alone or mixed together with other traditional cryopreservation agents. Carbohydrate sugars such as trehalose, sucrose, fructose, and raffinose, may be microinjected to concentrations less than or equal to about 1.0 M, and more preferably, less than or equal to about 0.4 M. In one aspect, the concentration is between 0.05 and 0.20 M, inclusive. Additionally, an extracellular sugar or traditional cryopreservation agent may be added prior to storage. If the cells were incubated in a hypertonic solution prior to microinjection, the substantially non-permeable solute may be allowed to remain in the media after microinjection or may be removed from the media by washing the cells with media containing a lower concentration, or none, of this solute.

Certain sugars or polysaccharides which ordinarily do not permeate cell membranes because they are too large to pass through the membrane have superior physiochemical and biological properties for cryopreservation purposes. While these sugars ordinarily do not permeate cell membranes on their own, using the method as described, these ordinarily non-permeating sugars may be microinjected intracellularly to result in a beneficial effect.

Non-permeating sugars having a stabilizing or preserving effect on cells that are especially useful as the cryopreservation agent in the present method include sucrose, trehalose, fructose, dextran, and raffinose. Among these sugars, trehalose, a non-reducing disaccharide of glucose, has been shown to be exceptionally effective in stabilizing cell structures at low concentrations. The addition of extracellular glycolipids or glycoproteins may also stabilize the cell membrane.

Following the microinjection of the cryopreservation agent, the cells are prepared for storage. A variety of methods for freezing and/or drying may be employed to prepare the cells for storage. In particular, three approaches are described herein: vacuum or air drying, freeze drying, and freeze-thaw protocols. Drying processes have the advantage that the stabilized biological material may be transported and stored at ambient temperatures.

Typically, oocytes loaded with 1 to 2M DMSO are cooled at a very slow cooling rate (0.3 to 0.5° C./min) to an intermediate temperature (−60° C. to −80° C.) before plunging in liquid nitrogen for storage. The sample can then be stored at this temperature.

The suspended material can then be stored at cryopreservation temperatures, for example, by leaving the vials in liquid nitrogen (LN_2), for the desired amount of time.

Protocols for vacuum or air drying and for freeze drying proteins are well characterized in the art (Franks et al., "Materials Science and the Production of Shelf-Stable Biologicals," BioPharm, October 1991, p. 39; Shalaev et al., "Changes in the Physical State of Model Mixtures during Freezing and Drying: Impact on Product Quality," Cryobiol. 33, 14-26 (1996)) and such protocols may be used to prepare cell suspensions for storage with the method as described. In addition to air drying, other convective drying methods that may be used to remove water from cell suspensions include the convective flow of nitrogen or other gases.

An exemplary evaporative vacuum drying protocol useful with the method of the invention may include placing 20 μl each into wells on 12 well plates and vacuum drying for 2 hours at ambient temperature. Of course, other drying methods could be used, including drying the cells in vials. Cells prepared in this manner may be stored dry, and rehydrated by diluting in DMEM or any other suitable media.

A method of the invention using freeze drying to prepare the cells for storage begins with freezing the cell suspension. While methods of freezing known in the art may be employed, the simple plunge freezing method described herein for the freeze-thaw method may also be used for the freezing step in the freeze drying protocol.

After freezing, a two stage drying process may be employed. In the first stage, energy of sublimation is added to vaporize frozen water. Secondary drying is performed after the pure crystalline ice in the sample has been sublimated. Freeze dried cells can be stored and hydrated in the same manner as described above for vacuum drying. Viable cells may then be recovered.

After the recovery of cells from a frozen or dried state, any external cryopreservation agent may be optionally removed from the culture media. For example, the media may be diluted by the addition of the corresponding media with a lower concentration of cryopreservation agent. For example, the recovered cells may be incubated for approximately five minutes in media containing a lower concentration of sugar than that used for cell storage. For this incubation, the media may contain the same sugar that was used as the cryopreservation agent; a different cryopreservation agent, such as galactose; or any other substantially non-permeable solute. To minimize any osmotic shock induced by the decrease in the osmolarity of the media, the concentration of the extracellular cryopreservation agent may be slowly decreased by performing this dilution step multiple times, each time with a lower concentration of cryopreservation agent. These dilution steps may be repeated until there is no extracellular cryopreservation agent present or until the concentration of cryopreservation agent or the osmolarity of the media is reduced to a desired level.

The parthenogenetically activated oocytes, blastocysts, ICM, and autologous stem cells can be stored or "banked" in a manner that allows the cells to be revived as needed in the future. An aliquot of the parthenogenetically activated oocytes and autologous stem cells can be removed at any time, to be grown into cultures of many undifferentiated cells and then differentiated into a particular cell type or tissue type, and may then be used to treat a disease or to replace malfunctioning tissues in a subject. Since the cells are parthenogenetically derived from the donor, the cells can be stored so that an individual or close relative can have access to cells for an extended period of time.

In one embodiment, a cell bank is provided for storing parthenogenetically activated oocytes, blastocysts, ICM, and/or autologous stem cell samples. In another embodiment, methods for administering such a cell bank are provided. U.S. Published Patent Application No. 20030215942, which is incorporated by reference herein in its entirety, provides an example of a stem cell bank system.

Using methods such as those described above, the isolation and in vitro propagation of parthenogenetically activated oocytes, blastocysts, ICM, and autologous stem cell samples and their cryopreservation facilitates the establishment of a "bank" of transplantable human stem cells. Because it is possible to store smaller aliquots of cells, the banking procedure could take up a relatively small space. Therefore, the cells of many individuals could be stored or "banked" on a short term or long term basis, with relatively little expense.

In one embodiment, a portion of the sample is made available for testing, either before or after processing and storage.

This invention also provides methods of recording or indexing the parthenogenetically activated oocyte, blastocyst, ICM, and/or autologous stem cell samples so that when a sample needs to be located, it can be easily retrieved. Any indexing and retrieval system can be used to fulfill this purpose. Any suitable type of storage system can be used so that the parthenogenetically activated oocytes, blastocysts, ICM, and/or autologous stem cells can be stored. The samples can be designed to store individual samples, or can be designed to store hundreds, thousands, and even millions of different cell samples.

The stored parthenogenetically activated oocyte, blastocyst, ICM, and/or autologous stem cell samples can be indexed for reliable and accurate retrieval. For example, each sample can be marked with alphanumeric codes, bar codes, or any other method or combinations thereof. There may also be an accessible and readable listing of information enabling identification of each parthenogenetically activated oocyte, blastocyst, ICM, and/or autologous stem cell sample and its location in the bank and enabling identification of the source and/or type the cell sample, which is outside of the bank. This indexing system can be managed in any way known in the art, e.g., manually or non-manually, e.g. a computer and conventional software can be used.

In one embodiment, the cell samples are organized using an indexing system so that the sample will be available for the donor's use whenever needed. In other embodiments, the cell samples can be utilized by individuals related to the original donor. Once recorded into the indexing system, the cell sample can be made available for matching purposes, e.g., a matching program will identify an individual with matching type information and the individual will have the option of being provided the matching sample.

The storage banking system can comprise a system for storing a plurality of records associated with a plurality of individuals and a plurality of cell samples. Each record may contain type information, genotypic information or phenotypic information associated with the cell samples or specific individuals. In one embodiment, the system will include a cross-match table that matches types of the samples with types of individuals who wish to receive a sample.

In one embodiment, the database system stores information for each parthenogenetically activated oocyte, blastocyst, ICM, and/or autologous stem cell sample in the bank. Certain information is stored in association with each sample. The information may be associated with a particular donor, for example, an identification of the donor and the donor's medical history. For example, each sample may be HLA typed and the HLA type information may be stored in association with each sample. The information stored may also be availability information. The information stored with each sample is searchable and identifies the sample in such a way that it can be located and supplied to the client immediately.

Accordingly, embodiments of the invention utilize computer-based systems that contain information such as the donor, date of submission, type of cells submitted, types of cell surface markers present, genetic information relating to the donor, or other pertinent information, and storage details such as maintenance records and the location of the stored samples, and other useful information.

The term "a computer-based system" refers to the hardware, software, and any database used to store, search, and retrieve information about the stored cells. The computer-based system preferably includes the storage media described above, and a processor for accessing and manipulating the data. The hardware of the computer-based systems of this embodiment comprises a central processing unit (CPU) and a database. A skilled artisan can readily appreciate that any one of the currently available computer-based systems are suitable.

In one embodiment, the computer system includes a processor connected to a bus that is connected to a main memory (preferably implemented as RAM) and a variety of secondary storage devices, such as a hard drive and removable medium storage device. The removable medium storage device can represent, for example, a floppy disk drive, a DVD drive, an optical disk drive, a compact disk drive, a magnetic tape drive, etc. A removable storage medium, such as a floppy disk, a compact disk, a magnetic tape, etc. containing control logic and/or data recorded therein can be inserted into the removable storage device. The computer system includes appropriate software for reading the control logic and/or the data from the removable medium storage device once inserted in the removable medium storage device. Information relating to the parthenogenetically activated oocyte, blastocyst, ICM, and/or autologous stem cell can be stored in a well known manner in the main memory, any of the secondary storage devices, and/or a removable storage medium. Software for accessing and processing these data (such as search tools, compare tools, etc.) reside in main memory during execution.

As used herein, "a database" refers to memory that can store any useful information relating to the parthenogenetically activated oocyte and/or autologous stem cell collections and the donors.

The data relating to the stored parthenogenetically activated oocyte, blastocyst, ICM, and/or autologous stem cell can be stored and manipulated in a variety of data processor programs in a variety of formats. For example, the data can be stored as text in a word processing file, such as Microsoft WORD or WORDPERFECT, an ASCII file, an html file, or a pdf file in a variety of database programs familiar to those of skill in the art, such as DB2, SYBASE, or ORACLE.

A "search program" refers to one or more programs that are implemented on the computer-based system to search for details or compare information relating to the cryopreserved samples within a database. A "retrieval program" refers to one or more programs that can be implemented on the computer-based system to identify parameters of interest in the database. For example, a retrieval program can be used to find samples that fit a particular profile, samples having specific markers or DNA sequences, or to find the location of samples corresponding to particular individuals.

There is no upper limit on the number of cell samples that can be stored in one cell bank. In one embodiment, hundreds of products from different individuals will be stored at one bank or storage facility. In another embodiment, up to millions of products may be stored in one storage facility. A single storage facility may be used to store parthenogenetically activated oocyte and/or autologous stem cell samples, or multiple storage facilities may be used.

In some embodiments of the present invention, the storage facility may have a means for any method of organizing and indexing the stored cell samples, such as, for example, auto-

mated robotic retrieval mechanisms and cell sample manipulation mechanisms. The facility may include micromanipulation devices for processing cell samples. Known conventional technologies can be used for efficient storage and retrieval of the cell samples. Exemplary technologies include but are not limited to Machine Vision, Robotics, Automated Guided Vehicle System, Automated Storage and Retrieval Systems, Computer Integrated Manufacturing, Computer Aided Process Planning, Statistical Process Control, and the like.

The type information or other information associated with the individual in need of a sample may be recorded into a system that can be used to identify an appropriate matching product, such as, for example, a database system, an indexing system, and the like. Once recorded in the system, a match can be made between the type of the individual and a donor cell sample. In preferred embodiments, the donor sample is from the same individual as the individual in need of the sample. However, similar but not identical donor/recipient matches can also be used. The matching sample is available for the individual possessing the matching type identifier. In one embodiment of this invention, the individual's identification information is stored in connection with the cell sample. In some embodiments, the matching process occurs around the time of harvesting the sample, or can occur at any time during processing, storage, or when a need arises. Accordingly, in some embodiments of the invention, the matching process occurs before the individual is in actual need of the cell sample.

When the parthenogenetically activated oocyte, blastocyst, ICM, and/or autologous stem cell sample is needed by an individual, it may be retrieved and made available for research, transplantation or other purposes within minutes, if desired. The sample may also be further processed to prepare it for transplantation or other needs.

Normally, the oocyte is ovulated at this stage and fertilized by the sperm. The sperm initiates the completion of meiosis in a process called activation. During activation, the pairs of chromatids separate, the second polar body is extruded, and the oocyte retains a haploid number of chromosomes, each with one chromatid. The sperm contributes the other haploid complement of chromosomes to make a full diploid cell with single chromatids. The chromosomes then progress through DNA synthesis during the first cell cycle. These cells then develop into embryos.

By contrast, embryos described herein are developed by artificial activation of cells, typically mammalian oocytes or blastomeres containing DNA of all male or female origin. As discussed in the background of the invention, many methods have been reported in the literature for artificial activation of unfertilized oocytes. Such methods include physical methods, e.g., mechanical methods such as pricking, manipulation or oocytes in culture, thermal methods such as cooling and heating, repeated electric pulses, enzymatic treatments, such as trypsin, pronase, hyaluronidase, osmotic treatments, ionic treatments such as with divalent cations and calcium ionophores, such as ionomycin and A23187, the use of anesthetics such as ether, ethanol, tetracaine, lignocaine, procaine, phenothiazine, tranquilizers such as thioridazine, trifluoperazine, fluphenazine, chlorpromazine, the use of protein synthesis inhibitors such as cycloheximide, puromycin, the use of phosphorylation inhibitors, e.g., protein kinase inhibitors such as staurosporine, 2-aminopurine, sphingosine, and DMAP, combinations thereof, as well as other methods.

Such activation methods are well known in the art and are discussed U.S. Pat. No. 5,945,577, incorporated herein by reference.

In one embodiment, a human cell in metaphase II, typically an oocyte or blastomere comprising DNA of all male or female origin, is artificially activated for effecting artificial activation of oocytes.

In a related aspect, the activated cell, e.g., oocyte, which is diploid, is allowed to develop into an embryo that comprises a trophectoderm and an inner cell mass. This can be effected using known methods and culture media that facilitate blastocyst development.

After the gynogenetic embryos have been cultured to produce a discernable trophectoderm and inner cell mass, the cells of the inner cell mass are then used to produce the desired pluripotent cell lines. This can be accomplished by transferring cells derived from the inner cell mass or the entire inner cell mass onto a culture that inhibits differentiation. This can be effected by transferring the inner cell mass cells onto a feeder layer that inhibits differentiation, e.g., fibroblasts or epithelial cells, such as fibroblasts derived from postnatal human tissues, etc., or other cells that produce LIF. Other factors/components may be employed to provide appropriate culture conditions for maintaining cells in the undifferentiated state including, but not limited to, addition of conditioned media (Amit et al., Developmental Biol (2000) 227:271-278), bFGF and TGF-β1 (with or without LIF) (Amit et al., Biol Reprod (2004) 70:837-845), factors which activate the gp130/STAT3 pathway (Hoffman and Carpenter, Nature Biotech (2005) 23(6):699-708), factors which activate the PI3K/Akt, PKB pathway (Kim et al., FEBS Lett (2005) 579:534-540), factors that are members of the bone morphogenetic protein (BMP) super family (Hoffman and Carpenter (2005), supra), and factors which activate the canonical/β-catenin Wnt signaling pathway (e.g., GSK-3-specific inhibitor; Sato et al., Nat Med (2004) 10:55-63). In a related aspect, such factors may comprise culture conditions that include feeder cells and/or ECM substrates (Hoffman and Carpenter (2005), supra).

In one aspect, the inner cell mass cells are cultured on human postnatal foreskin or dermal fibroblast cells or other cells which produce leukemia inhibitory factor, or in the presence of leukemia inhibitory factor. In a related aspect, feeder cells are inactivated prior to seeding with the ICM. For example, the feeder cells can be mitotically inactivated using an antibiotic. In a related aspect, the antibiotic can be, but is not limited to, mitomycin C.

Culturing will be effected under conditions that maintain the cells in an undifferentiated, pluripotent state, for prolonged periods, theoretically indefinitely. In one embodiment, oocytes are parthenogenically activated with calcium ionophores under high O_2 tension followed by contacting the oocytes with a serine-threonine kinase inhibitor under low O_2 tension. The resulting ICM from the parthenogenically activated oocytes is cultured under high O_2 tension, where the cells, for example, are maintained using a gas mixture comprising 20% O_2. In one aspect, culturable refers to being capable of, or fit for, being cultivated. In a related aspect, ICM isolation is carried out mechanically after four days of blastocyst cultivation, where the cultivation is carried out on feeder cells. Such cultivation, for example, eliminates the need to use materials derived from animal sources, as would be the case for immunosurgery.

In a related aspect, culture media for the ICM is supplemented with non-animal sera, including but not limited to, human umbilical cord serum, where the serum is present in defined media (e.g., IVF, available from MediCult A/S, Denmark; Vitrolife, Sweden; or Zander IVF, Inc., Vero Beach, Fla.). In another aspect, the media and processes as provided are free of animal products. In a related aspect, animal prod-

ucts are those products, including serum, interferons, chemokines, cytokines, hormones, and growth factors, that are from non-human sources.

The pluripotent state of the cells produced by the present invention can be confirmed by various methods. For example, the cells can be tested for the presence or absence of characteristic ES cell markers. In the case of human ES cells, examples of such markers are identified supra, and include SSEA-4, SSEA-3, TRA-1-60, TRA-1-81 and OCT 4, and are known in the art.

Also, pluripotency can be confirmed by injecting the cells into a suitable animal, e.g., a SCID mouse, and observing the production of differentiated cells and tissues. Still another method of confirming pluripotency is using the subject pluripotent cells to generate chimeric animals and observing the contribution of the introduced cells to different cell types. Methods for producing chimeric animals are well known in the art and are described in U.S. Pat. No. 6,642,433, incorporated by reference herein.

Yet another method of confirming pluripotency is to observe ES cell differentiation into embryoid bodies and other differentiated cell types when cultured under conditions that favor differentiation (e.g., removal of fibroblast feeder layers). This method has been utilized and it has been confirmed that the subject pluripotent cells give rise to embryoid bodies and different differentiated cell types in tissue culture.

The resultant pluripotent cells and cell lines, preferably human pluripotent cells and cell lines, which are derived from DNA of entirely female original, have numerous therapeutic and diagnostic applications. Such pluripotent cells may be used for cell transplantation therapies or gene therapy (if genetically modified) in the treatment of numerous disease conditions.

In this regard, it is known that mouse embryonic stem (ES) cells are capable of differentiating into almost any cell type. Therefore, human pluripotent (ES) cells produced according to the invention should possess similar differentiation capacity. The pluripotent cells according to the invention will be induced to differentiate to obtain the desired cell types according to known methods. For example, human ES cells produced according to the invention may be induced to differentiate into hematopoietic stem cells, muscle cells, cardiac muscle cells, liver cells, islet cells, retinal cells, cartilage cells, epithelial cells, urinary tract cells, etc., by culturing such cells in differentiation medium and under conditions which provide for cell differentiation. Medium and methods which result in the differentiation of ES cells are known in the art as are suitable culturing conditions.

For example, Palacios et al, Proc. Natl. Acad. Sci., USA, 92:7530-7537 (1995) teach the production of hematopoietic stem cells from an embryonic cell line by subjecting stem cells to an induction procedure comprising initially culturing aggregates of such cells in a suspension culture medium lacking retinoic acid followed by culturing in the same medium containing retinoic acid, followed by transferal of cell aggregates to a substrate which provides for cell attachment.

Moreover, Pedersen, J. Reprod. Fertil. Dev., 6:543-552 (1994) is a review article which references numerous articles disclosing methods for in vitro differentiation of embryonic stem cells to produce various differentiated cell types including hematopoietic cells, muscle, cardiac muscle, nerve cells, among others.

Further, Bain et al, Dev. Biol., 168:342-357 (1995) teach in vitro differentiation of embryonic stem cells to produce neural cells which possess neuronal properties. These references are exemplary of reported methods for obtaining differentiated cells from embryonic or stem cells. These references and in particular the disclosures therein relating to methods for differentiating embryonic stem cells are incorporated by reference in their entirety herein. Thus, using known methods and culture medium, one skilled in the art may culture the subject ES cells, including genetically engineered or transgenic ES cells, to obtain desired differentiated cell types, e.g., neural cells, muscle cells, hematopoietic cells, etc. Pluripotent cells produced by the methods described herein may be used to obtain any desired differentiated cell type. Therapeutic usages of differentiated human cells are unparalleled. For example, human hematopoietic stem cells may be used in medical treatments requiring bone marrow transplantation. Such procedures are used to treat many diseases, e.g., late stage cancers such as ovarian cancer and leukemia, as well as diseases that compromise the immune system, such as AIDS. Hematopoietic stem cells can be obtained, e.g., by incorporating male or female DNA derived from a male or female cancer or AIDS patient with an enucleated oocyte, obtaining pluripotent cells as described above, and culturing such cells under conditions which favor differentiation, until hematopoietic stem cells are obtained. Such hematopoietic cells may be used in the treatment of diseases including cancer and AIDS.

Alternatively, the subject pluripotent cells may be used to treat a patient with a neurological disorder by culturing such cells under differentiation conditions that produce neural cell lines. Specific diseases treatable by transplantation of such human neural cells include, by way of example, Parkinson's disease, Alzheimer's disease, ALS and cerebral palsy, among others. In the specific case of Parkinson's disease, it has been demonstrated that transplanted fetal brain neural cells make the proper connections with surrounding cells and produce dopamine. This can result in long-term reversal of Parkinson's disease symptoms. In a related aspect, nerve precursors can be used to reanneal severed/damaged nerve fibers to restore movement after hand, leg, and spinal cord injuries.

One object of the subject invention is that it provides an essentially limitless supply of pluripotent, human cells that can be used to produce differentiated cells suitable for autologous transplantation for the oocyte donor. Human embryonic stem cells and their differentiated progeny derived from blastocysts remaining after infertility treatments, or created using NT, will likely be rejected by a recipient's immune system when used in allogenic cell transplantation therapy. Parthenogenically derived stem cells should result in differentiated cells that could alleviate the significant problem associated with current transplantation methods, i.e., rejection of the transplanted tissue which may occur because of host-vs-graft or graft-vs-host rejection relative to the oocyte donor. Conventionally, rejection is prevented or reduced by the administration of anti-rejection drugs such as cyclosporin. However, such drugs have significant adverse side-effects, e.g., immunosuppression, carcinogenic properties, as well as being very expensive. Cells produced by the methods as disclosed should eliminate, or at least greatly reduce, the need for anti-rejection drugs relative to the oocyte donor.

Another object of the subject invention is that it provides an essentially limitless supply of pluripotent, human cells that can be used to produce differentiated cells suitable for allogenic transplantation to members of the oocyte donor's family (e.g., siblings). The cells will be immunologically and genetically similar to those of the oocytes donor's direct family members and thus less likely to be rejected by the donor's family members.

Another object of this method is that parthenogenic activation of mammalian oocytes is a relatively simple procedure

when compared to SCNT and results in the creation of stem cells with less cell manipulation.

Parthenogenic activation of mammalian oocytes has shown to be more efficient in the creation of stem cells than methods requiring mechanical manipulation of the oocyte (e.g., SCNT).

One drawback of SCNT is that subjects with deficient mitochondrial respiratory chain activity present phenotypes with striking similarities to abnormalities commonly encountered in SCNT fetuses and offspring (Hiendleder et al, Repro Fertil Dev (2005) 17(1-2):69-83). Cells normally contain only one type of mitochondrial DNA (mtDNA), termed homoplasmy, however, heteroplasmy does exist, usually as a combination of mutant and wild-type mt DNA molecules or form a combination of wild-type variants (Spikings et al., Hum Repro Update (2006) 12(4):401-415). As heteroplasmy can result in mitochondrial disease, various mechanisms exist to ensure maternal-only transmission. However, with the increasing use of protocols which bypass normal mechanisms for homoplasmy maintenance (e.g., cytoplasmic transfer (CT) and SCNT), perturbed mitochondrial function may be intrinsic to stem cells derived from these sources.

In one aspect, as the parthenotes are uniparental, the possibility of heteroplasmy is minimized.

Other diseases and conditions treatable by cell therapy include, by way of example, spinal cord injuries, multiple sclerosis, muscular dystrophy, diabetes, liver diseases Including acute diseases (viral hepatitis, drug overdoses (acetaminophen) and others), chronic diseases (chronic hepatitis and others (generally leading to cirrhosis)), heritable liver defects (hemophilia B, factor IX deficiency, bulirubin metabolism defects, urea cycle defects, lysosomal storage disease, a1-antitrypsin deficiency and others), heart diseases, cartilage replacement, burns, foot ulcers, gastrointestinal diseases, vascular diseases, kidney disease, retinal disease, urinary tract disease, and aging related diseases and conditions.

This methodology can be used to replace defective genes, e.g., defective immune system genes, cystic fibrosis genes, or to introduce genes which result in the expression of therapeutically beneficial proteins such as growth factors, lymphokines, cytokines, enzymes, etc.

For example, the gene encoding brain derived growth factor may be introduced into human pluripotent cells produced according to the invention, the cells differentiated into neural cells and the cells transplanted into a Parkinson's patient to retard the loss of neural cells during such disease.

Also, the subject pluripotent human ES cells, may be used as an in vitro model of differentiation, in particular for the study of genes which are involved in the regulation of early development. Also, differentiated cell tissues and organs produced using the subject ES cells may be used in drug studies.

Further, the subject ES cells or differentiated cells derived therefrom may be used as nuclear donors for the production of other ES cells and cell colonies.

Still further, pluripotent cells obtained according to the present disclosure may be used to identify proteins and genes that are involved in embryogenesis. This can be effected, e.g., by differential expression, i.e., by comparing mRNAs that are expressed in pluripotent cells provided according to the invention to mRNAs that are expressed as these cells differentiate into different cell types, e.g., neural cells, myocardiocytes, other muscle cells, skin cells, etc. Thereby, it may be possible to determine what genes are involved in differentiation of specific cell types.

Further, ES cells and/or their differentiated progeny that have specific genetic defects, such as the genetic defect that leads to Duchene's Muscular Dystrophy, may be used as models to study the specific disease associated with the genetic defect.

Also, it is another object of the present disclosure to expose pluripotent cell lines produced according to the described methods to cocktails of different growth factors, at different concentrations and under different cell culture conditions such as cultured on different cell matrices or under different partial pressures of gases so as to identify conditions that induce the production and proliferation of desired differentiated cell types.

The following examples are intended to illustrate but not limit the invention.

EXAMPLE 1

Production of Human Parthenogenic Embryogenic Stem Cells

Materials and Methods

Donors voluntarily donated oocytes, cumulous cells, and blood (for DNA analysis) with no financial payment. Donors signed comprehensive informed consent documents and were informed that all donated materials were to be used for research and not for reproductive purposes. Before ovarian stimulation, oocyte donors underwent medical examination for suitability according to FDA eligibility determination guidelines for donors of human cells, tissues, and cellular and tissue-based products (Food and Drug Administration. (Draft) Guidance for Industry: Eligibility Determination for Donors of Human Cells, Tissues, and Cellular and Tissue Based Products (HCT/Ps) dated May 2004) and order N 67 (02.26.03) of Russian Public Health Ministry. It included X-ray, blood and urine analysis, and liver function test. Donors were also screened for syphilis, HIV, HBV, and HCV.

Oocytes were obtained using standard hormonal stimulation to produce superovulation in the subject donor. Each donor egg underwent ovarian stimulation by FSH from the 3rd to the 13th days of their menstrual cycle. A total of 1500IU of FSh was given. From the 10th to the 14th day of the donor's menstrual cycle, gonadoliberin antagonist Orgalutran (Organon, Holland) was injected at 0.25 mg/day. From the 12th to the 14th day of the donor's menstrual cycle a daily injection of 75IU FSH+75IU LH (Menopur, Ferring GmbH, Germany(was given, If an ultrasound examination displayed follicles between 18 and 20 mm in diameter, a single 8000IU dose of hGC (Choragon, Ferring GmbH, Germany) was administered on the 14th day of the donor's menstrual cycle. Trans-vaginal punction was performed 35 hours after hCG injection on approximately the 16th day. Follicular fluid was collected from the antral follicles of anesthetized donors by ultrasound-guided needle aspiration into sterile tubes.

Cumulus oocyte complexes (COCs) were picked from the follicular fluid, washed in Flushing Medium (MediCult) and then incubated in Universal IVF medium (MediCult, see Table 1) with a Liquid Paraffin (MediCult) overlay for 2 hours in a 20% O_2, 5% CO_2, at 37° C. humidified atmosphere.

TABLE 1

IVF media.

COMPOSITION
Calcium Chloride
EDTA
Glucose
Human Serum Albumin

TABLE 1-continued

IVF media. COMPOSITION
Magnesium Sulfate
Penicillin G
Potassium Chloride
Potassium di-Hydrogen Phosphate
Sodium Bicarbonate
Sodium Chloride
Sodium Lactate
Sodium Pyruvate
Water

Before activation, cumulus-oocyte complexes (COCs) were treated with SynVitro Hyadase (MediCult, A/S, Denmark) to remove cumulus cells followed by incubation in Universal IVF medium with a paraffin overlay for 30 minutes.

From this point onward, the culture of oocytes and embryos was performed in a humidified atmosphere at 37° C. using O_2-reduced gas mixture (90% N_2+5% O_2+5% CO_2), with the exception of the ionomycin treatment. The oocytes were activated by incubation in 5 μM ionomycin for 5 minutes in a CO_2 incubator at 37° C. in a gas environment of 20% O_2, 5% CO_2, followed by culture with 1 mM 6-dimethylaminopurine (DMAP) for 4 hours in IVF medium, with paraffin overlay, in a gas environment of 90% N_2, 5% O_2, and 5% CO_2 at 37° C. The oocytes were then washed 3 times in IVF. Activation and cultivation were carried out in 4-well plates (Nunclon, A/S, Denmark) in 500 μl of medium overlaid with liquid paraffin oil (MediCult, A/S, Denmark).

Activated oocytes were cultivated in IVF medium in a gas environment comprising 5% O_2, 5% CO_2, and 90% N_2, and embryos generated from the activated oocytes were cultured in the same gas mixture.

Activated oocytes were allowed to incubate in IVF under the above conditions (i.e., low O_2 tension) until fully expanded blastocysts containing an inner cell mass (ICM) at a Blastocyst Scoring Modification of 1AA or 2AA (Shady Grove Fertility Center, Rockville, Md., and Georgia Reproductive Specialists, Atlanta, Ga.) was observed.

The zona pellucida was removed by 0.5% pronase (Sigma, St. Louis) treatment. The ICM from blastocysts was isolated by immuno-surgery where the blastocysts were incubated with horse antiserum to human spleen cells followed by exposure to guinea pig complement. Trophoectodern cells were removed from the ICM by gently pipetting the treated blastocysts.

For the derivation of ICM from whole blastocysts, the blastocysts were placed on a feeder layer in medium designed for culture of phESC (i.e., VitroHES™ media (e.g., DMEM/high glucose medium, VitroLife, Sweden) supplemented with 10% human umbilical cord blood serum, 5 ng/ml human recombinant LIF (Chemicon Int'l, Inc., Temecula, Calif.), 4 ng/ml recombinant human FGF (Chemicon Int'l, Inc., Temecula, Calif.) and penicillin-streptomycin (100 U/100 μg)). When blastocysts attached and trophoplast cells spread, the ICM became visible. Through three to four days of additional culture, the ICM was isolated through mechanical slicing of the ICM from the trophoectoderm outgrowth using a finely drawn glass pipette. Further, the IMC cells were cultured on a feeder cell layer of mitotically inactivated post natal human dermal fibroblasts, in VirtroHES™ media (as formulated above) in a 96-well plate in 5% CO_2 and 20% O_2 at 37° C. This gas mixture was used to culture stem cells. Human fibroblast cultures were made using non-animal materials. Inactivation of fibroblasts was carried out using 10 μg/ml mitomycin C (Sigma, St. Louis, Mo.) for 3 hours.

In a separate method, immuno-surgery was performed by incubating blastocysts with horse antiserum to human spleen cells followed by exposure to rabbit complement. The trophectoderm cells were removed from the ICM through gentle pipetting of the treated blastocyts. Further culturing of the isolated ICMs was performed on a feeder layer of neonatal human skin fibroblasts (HSF) obtained from a genetically unrelated individual (with parental consent) derived using medium containing human umbilical cord blood serum. The HSF feeder layer was mitotically inactivated using mitomycin C.

The medium for the culture of HSF consisted of 90% DMEM (high glucose, with L-glutamaine (Invitrogen), 10% human umbilical cord blood serum and penicillin-streptomycin (100 U/100 mg) Invitrogen).

For the culture of ICM and phESC, VitroHES™ (Vitrolife) supplemented with 4 ng/ml hrbFGF, 5 ng/ml hrLIF and 10% human umbilical cord blood serum was used. The ICM was mechanically plated on a fresh feeder layer and cultured for three to four days. The first colony was mechanically cut and replated after five days of culture. All subsequent passages were made after five to six days in culture. For early passages, colonies were mechanically divided into clumps and replated. Further passing of phESC was performed with collagenase IV treatment and mechanical dissociation. The propagation of phESC was performed at 37° C., 5% CO_2 in a humidified atmosphere.

Oocyte Activation

From the initial donor, four oocytes were activated, and the activated oocytes were cultivated in IVF medium in a gas environment comprising 5% O_2, 5% CO_2, and 90% N_2 and followed over five (5) days. Table 2 shows the progress of maturation of the activated oocytes. Each oocyte was separated in a 4-well plate.

TABLE 2

	Cultured Activated Oocytes.*			
	Day 1	Day 2	Day 3	Day 5
N1	1 pronucleus (pn), 1 polar body (pb)	2 blastomers (bl) equal, fragmentation (fr)-0%	4 bl equal, fr-2%	1 morula, fr-15%
N2	0 pn, 1 pb	4 bl not equal, fr-4%	5 bl not equal, fr-20%	4 bl not equal, fr-40%
N3	1 pn, 1 pb	2 bl not equal, fr-0%	6 bl equal, fr-0%	early blastocysts
N4	1 pn, 1 pb	4 bl equal, fr-10%	4 bl equal, fr-20%	Fully expanded blastocyst with good ICM 1AA

*Cells were incubated in M1 ™ media (MediCult) on the first day and M2 ™ media (MediCult) on days 2-5. Media was changed everyday. M1 ™ and M2 ™ contain human serum albumin, glucose and derived metabolites, physiological salts, essential amino acids, non-essential amino acids, vitamins, nucleotides, sodium bicarbonate, streptomycin (40 mg/l), penicillin (40.000 IU/l) and phenol red.

Inner cell masses were isolated from N4 and transferred to human fibroblast feeder cells as outlined above. N1 and N2 degenerated on Day 6. Further, on Day 6, N3 produced fully expanded blastocyst with ICM 2AB. N3 was then transferred to human fibroblast feeder cells on Day 6. ICM from N4 was unchanged. N3 was used to isolate stem cells.

ICM cells were cultivated in VitroHES™ medium in a gas environment comprising 5% CO_2, and 95% N_2 and followed over forty-five (45) days. Table 2a shows the progress of N3 ICM cell cultivation.

TABLE 2a

Progress of N3-ICM Cultivation.*

Day 3	ICM transplanted on fresh feeder cells.
Day 8	Colony of cells divided mechanically into 6 pieces and cultivated in 3 wells of a 96-well plate-1st passage.
Day 14	From five (5) colonies of 1st passage, cells were mechanically divided, and 20 colonies of a 2nd passage were cultivated in 3 wells of a 24-well plate.
Day 20	Cells were plated in 35 mm dish-3rd passage.
Day 24	Five (5) 35 mm dishes were seeded with cells-4th passage. One dish was divided chemically with 5% pronase (Sigma) at room temperature.
Day 30	Twenty-five (25) 35 mm were seeded with cells-5th** passage.
Day 34	6th** cell passage.
Day 35	11 ampules were frozen from the 6th passage.
Day 37	7th** cell passage.
Day 44	12 ampules were frozen from the 7th passage.
Day 45	8th cell passage.

*Cells were grown on M2 ™ media (MediaCult).
**These passages were made with pronase digestion.

Stem Cell Isolation.

From the oocytes from 5 donors, the use of MediCult media followed by a culture under reduced oxygen allowed for the production of 23 blastocysts on the fifth or sixth day of culture. Eleven of the blastocysts had visible ICMs (Table 3).

TABLE 3

Generation of Parthenotes and Parthenogenetic Embryonic Stem Cell Lines.

					Blastocysts derived		
Donor Number	Oocytes harvested	Oocytes donated	Normally activated oocytes	Parthenotes created	With ICM	Without visible ICM	Lines generated
1	8	4	4	4	2	—	phESC-1 immunosurgery
2	15	8	8	8	3	3	phESC-3 phESC-4 phESC-5 all from whole blastocysts
3	27	14	12[1]	11[2]	3	2	phESC-6 from whole blastocysts
4	22	11	10[3]	10	2	3	phESC-7 from whole blastocysts
5	20	9[4]	7	7	1	4	No cell line generated

[1]two oocytes were not activated;
[2]one oocyte degenerated after activation;
[3]one oocyte was not activated;
[4]two oocytes were at metaphase stage I and were discarded.

These results indicate an approximate 57.5% success rate in the formation of blastocysts from parthenogenetically activated oocytes.

Immunohistochemical Staining

For immunostaining, hES cell colonies and phESC cells on feeder layers were seeded onto micro cover glass, washed twice with PBS and fixed with 100% methanol for 5 minutes at −20° C. Cells were washed twice with PBS+0.05% Tween-20 and permeabilized with PBS+0.1% Triton X-100 for 10 minutes at room temperature. After cell washing, non-specific binding was blocked by incubation with blocking solution (PBS+0.05% Tween-20+four percent goat serum plus three percent human umbilical cord blood serum) for 30 minutes at room temperature (RT). Monoclonal antibodies were diluted in blocking solution and used for one hour at RT: SSEA-1 (MAB4301) (1:30), SSEA-3 (MAB4303) (1:10), SSEA-4 (MAB4304) (1:50), OCT-4 (MAB4305) (1:30), TRA-1-60 (MAB4360) (1:50), and TRA-1-81 (MAB4381) (1:50) from Chemicon. After the cells were washed, secondary antibodies Alexa Fluor 546 (orange-fluorescent) and 488 (green-fluorescent) (Molecular Probes, Invitrogen) were diluted 1:1000 in PBS+0.05% Tween-20 and applied for one hour at RT. Cells were washed and nuclei were stained with DAPI (Sigma) 0.1 μg/ml in PBS+0.05% Tween-20 during ten minutes at RT. Cells were washed and mounted on slides with Mowiol (Calbiochem). Fluorescence images were visualized with a fluorescence microscope.

For the detection of mesodermal markers in three week old embryoid bodies or in contractile embryoid bodies, monoclonal mouse anti-desmina antibody anti-human alpha actinin antibody (Chemicon) as the muscle specific markers, and anti-human CD31/PECAM-1 antibody (R&D Systems), anti-human VE Cadherin (DC144) antibody (R&D Systems) as the endothelial markers were used.

For detection of the endodermal markers in embryoid bodies, monoclonal mouse anti-human alpha-fetoprotein antibody (R&D Systems) was used.

Alkaline Phosphatase and Telomerase Activity

Alkaline phosphatase and telomerase activity were performed according to the manufacturer's specifications with AP kit and TRAPEZE™ Kit (Chemicon).

Karyotyping

To analyse the karyotype, hES cells were treated with 10 μg/ml Demecolcine (Sigma) for two hours, harvested with 0.05% trypsin/EDTA (Invitrogen) and centrifuged at 700× rpm for three minutes. The pellet was resuspended in 5 ml of 0.56% KCl, and incubated for 15 minutes at RT. After repeated centrifugation, the supernatant was removed and cells were resuspended and fixed with 5 ml of an ice cold mixture of methanol/acetic acid (3:1) for five minutes at +4° C. The fixation of the cells was repeated twice, after that the

cell suspension was placed onto microscope slides and the preparations were stained with Giemsa Modified Stain (Sigma). Metaphases from cells prepared in this manner were analyzed by a standard G-banding method. Quantity of 5/1000 metaphase spreads were revealed and 63 metaphases were analyzed.

Embryoid Body Formation

hES and phESC cell colonies were mechanically divided into clumps and placed in wells of a 24 well plate precoated with 1.5% agarose (Sigma) in medium containing 85% Knockout DMEM, 15% human umbilical cord blood serum, 1×MEM NEAA, 1 mM Glutamax, 0.055 mM β-mercaptoethanol, penicillin-streptomycin (50 U/50 mg), 4 ng/ml hrbFGF (all from Invitrogen, except serum). Human EBs were cultured for 14 days in suspension culture and placed on a culture dish to give outgrowth or cultivated in suspension for an additional week.

Neural differentiation was induced by the cultivation of two week old embryoid bodies attached to a culture dish surface over a period of a week in differentiation medium: DMEM/F12, B27, 2 mM Glutamax, penicillin-streptomycin (100 U/100 μg) and 20 ng/ml hrbFGF (all from Invitrogen). Some embryoid bodies gave rise to differentiated cells with neural morphology, others were dissected and additionally cultured to produce neurospheres.

Rhythmically beating embryoid bodies appeared spontaneously following five days of culture after plating on an adhesive surface in the same medium as was used for embryoid body generation.

HLA Typing

Genomic DNA was extracted from donor blood, hES, phESC cells, and human newborn skin fibroblasts (NSFs) with Dynabeads DNA Direct Blood from Dynal (Invitrogen). HLA typing was performed by PCR with allele-specific sequencing primers (PCR-SSP, Protrans) according to the manufacturer's specifications. HLA class I genes (HLA A*,B*,Cw*) were typed with PROTRANS HLA A*B*Cw* defining A*01-A*80, B*07-B*83, Cw*01-Cw*18 regions. HLA class II genes (HLA DRB1*, DRB3*, DRB4*, DRB5*, DQA1*, DQB1*) were analysed with PROTRANS HLA DRB1* defining DRB1*01-DRB1*16 (DR1-DR18), DRB3*, DRB4*, DRB5* regions and PROTRANS HLA DQB1* DQA1* defining DQB1*02-DQB1*06 (DQ2-DQ9), DQA1*0101-DQA1*0601 regions. PCR amplification was achieved: at 94° C. for 2 min; 10 cycles at 94° C. for 10 sec, 65° C. for 1 min; 20 cycles at 94° C. for 10 sec, 61° C. for 50 sec, 72° C. for 30 sec. Amplified products were detected in 2% agarose gel.

Affimetrix SNP Microarray Analysis

Genomic DNA was isolated from blood, cumulus cells, phESC and NSF by phenol/chloroform extraction method. These DNA samples obtained from four Caucasian subjects were genotyped with Affimetrix Mapping 50K Hind 240 Array (part of Affimetrix GeneChip Mapping 100K kit). Initially, the dataset contained 57,244 binary SNP markers. Since the number of markers is more than would be necessary to identify the equivalency of genomic samples and to study heterozygosity, 15 (chromosomes 1-15) out of 22 autosomal chromosomes were chosen. The shorter seven chromosomes were removed to reduce the chance that no marker, or only a single marker for a given chromosome, is selected during random sampling. The 1,459 markers were analyzed by Relcheck (version 0.67, Copyright ©) 2000 Karl W. Broman, Johns Hopkins University, Licensed under GNU General Public License version 2 (June 1991)).

Genomic Imprinting Analysis

Total nucleic acid was prepared as described Li et al. (J Biol Chem (2002) 277(16):13518-13527). RNA and DNA were extracted from cells using Tri-reagent (Sigma) or by using an RNA preparation kit from Qiagen (Valencia, Calif.).

Northern blots containing RNA from the various samples (see FIG. **3**) were blotted onto filters by standard methods (See, e.g., Sambrook et al., Molecular Cloning: A Laboratory Manual, 1989, 2nd ed, Cold Spring Harbor Press). The Northern filter was hybridized with single stranded oligonucleotide probes that hybridized specifically to the mRNAs. The oligonucleotide probes were end-labeled with [γ^{32}P]ATP (Amersham Biosciences). The filters were subsequently washed three times for 10 min each with 0.2×SSC (1×SSC=0.15 M NaCl and 0.015 M sodium citrate) containing 0.1% SDS at 60° C. and analyzed by Phosphorlmager (Molecular Dynamics). The sequences of the oligonucleotide probes were obtained from sequences based on the following Accession Nos.: NP002393 (Peg1_2 and Peg1_A; for these genes, human PEG1 is transcribed from two alternative promoters, resulting in the transcription of two isoforms, of which only one (isoform 1_2) is imprinted. Paternal expression isoform 1 occurs in conjunction with an unmethylated CpG island in exon 1 of the paternal allele, whereas the corresponding CpG island in the maternal gene (isoform 1_A) is fully methylated. See, e.g., Li et al. (2002), supra); CAG29346 (SNRPN); AF087017 (H19); NR_001564 (inactive X specific transcripts-XIST); and P04406 (GAPDH).

DNA Fingerprinting Analysis

Genomic DNA was isolated from blood, hES cells, and NSFs through a phenol/chloroform extraction, digested with HinfI restriction enzyme (Fermentas) and loaded in a 0.8% agarose gel. Following electrophoresis, denatured DNA was transferred to a nylon membrane (Hybond N, Amersham) by Southern blotting and hybridized with ^{32}P-labeled (CAC) 5 oligonucleotide probe. mData were analysed after membrane exposition on X-ray film (Kodak XAR) using Cronex intensifying screens.

Monolocus PCR Genotyping

In order to determine allelic identities for minisatellite loci between blood donor DNA and stem cell DNA, 11 polymorphic sites ((1) 3' Apolipoprotein B hypervariable minisatellite locus (3'ApoB); (2) D1S80 (PMCT118) hypervariable minisatellite locus (D1S80); (3) D6S366; (4) D16S359; (5) D7S820; (6) Human von Willebrand factor gene hypervariable minisatellite locus II (vWFII); (7) D13S317; (8) Human von Willebrand factor gene hypervariable microsatellite locus (vWA); (9) Human c-fms proto-oncogene for CFS-1 receptor gene microsatellite locus (CSF1PO); (10) Human thyroid peroxidase gene microsatellite locus (TPOX); and (11) Human tyrosine hydroxylase gene microsatellite locus (TH01)) were analyzed by PCR genotyping. Allele frequencies for known populations (i.e., Russian and Caucasian-American populations) determined for the above polymorphic sites were compared to allele frequencies of these sites in test samples (i.e., hES, NSF, and donor blood DNA). Chromosomal location, Genbank locus and locus definition, repeat sequence data, allelic ladder range, VNTR ladder size range, other known alleles, allele sizes, PCR protocols, and allele frequency results for the 11 minisatellite loci of the disclosed populations analyzed are provided below.

(1) 3' Apolipoprotein B hypervariable minisatellite locus (3'ApoB VNTR)

Chromosomal location: 2p23-p23

GenBank locus and locus definition: APOB, apolipoprotein B (including Ag(x) antigen) untranslated region

Repeat sequence 5'-3': (TATAATTAAATATT TTATAAT-TAAAATATT)n (SEQ ID NO: 1)

Allelic ladder size range (bases): 450+10+2 primer+links

VNTR ladder size range (# of repeats, according to Ludwig et al, 1989): 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52

Other known alleles (# of repeats): 25, 27, 28, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 54, 55

Promega K562 DNA® Allele sizes (# of repeats): 36/36

PCR protocol:

Thermal cycler:	DNA Technology Ltd., Russia
Initial Incubation:	95° C., 2'
Cycling for 30 cycles:	
Denaturation	94° C., 1'
Elongation and primer linking	60° C., 2'
Extension step:	72° C., 5'
Hold step:	4° C., unlimited time

The analysis may be done as described in Verbenko et al. (Apolipoprotein B 3'-VNTR polymorphism in Eastern European populations. Eur J Hum Gen (2003) 11(1):444-451). See Table 4.

TABLE 4

Allele Frequencies for Russian Populations

Allele	Allele frequency	Number of Alleles observed
25	0.001	1
30	0.079	75
32	0.071	68
33	0.001	1
34	0.238	227
35	0.004	4
36	0.393	375
37	0.001	1
38	0.036	36
39	0.001	1
40	0.014	13
42	0.001	1
44	0.042	41
45	0.006	6
46	0.033	31
48	0.067	64
50	0.011	10
52	0.001	1

Homozygotes	94
Heterozygotes	333
Total samples	427

(2) D1S80 (pMCT118) hypervariable minisatellite locus (D1S80 VNTR)

Chromosomal location: 1p35-36

GenBank locus and locus definition: Human D1S80 and MCT118 gene

Repeat sequence 5'-3': (GAAGACAGACCACAG)n (SEQ ID NO: 2)

Allelic ladder size range (bases): 387-762

VNTR ladder size range (# of repeats): 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 34, 35, 36, 37, 40, 41

Other known alleles (# of repeats): 13, 14, 15, 38, 39,>41

Promega K562 DNA® Allele sizes (# of repeats): 18/29

PCR protocol:

Thermal cycler:	DNA Technology Ltd., Russia
Initial Incubation:	95° C., 2'
Cycling for 30 cycles:	
Denaturation	94° C., 45"
Primer linking	60° C., 30"
Elongation	72° C., 45"
Extension step:	72° C., 5'
Hold step:	4° C., unlimited time

The analysis may be done as described in Verbenko et al. (Allele frequencies for D1S80 (pMCT118) locus in some Eastern European populations. J Forensic Sci (2003) 48(1): 207-208). See Table 5.

TABLE 5

Allele Frequencies for Russian Populations

Allele	Allele frequency	Number of Alleles observed
18	0.280	33
20	0.017	2
21	0.009	1
22	0.042	5
23	0.017	2
24	0.390	46
25	0.017	2
26	0.025	3
28	0.068	8
29	0.009	1
30	0.034	4
31	0.059	7
33	0.017	2
34	0.008	1
36	0.008	1

Homozygotes	15
Heterozygotes	44
Total samples	59

(3) D6S366

Chromosomal location: 6q21-qter

GenBank locus and locus definition: NA

Allelic ladder size range (bases): 150-162

STR ladder size range (# of repeats): 12, 13, 15

Other known alleles (# of repeats): 10, 11, 14, 16, 17

Promega K562 DNA® Allele sizes (# of repeats): 13/14

PCR protocol:

Thermal cycler:	DNA Technology Ltd., Russia
Initial Incubation:	95° C., 2'
Cycling for 30 cycles:	
Denaturation	94° C., 1'
Elongation and primer linking	60° C., 2'
Extension step:	72° C., 5'
Hold step:	4° C., unlimited time

The analysis may be done as described in Efremov et al. (An expert evaluation of molecular genetic individualizing systems based on the HUMvWFII and D6S366 tetranucleotide tandem repeats. Sud Med Ekspert (1998) 41(2):33-36). See Table 6.

TABLE 6

Allele Frequencies for Russian Populations		
Allele	Allele frequency	Number of Alleles observed
10	0.008	3
11	0.059	21
12	0.316	112
13	0.251	89
14	0.085	30
15	0.175	62
16	0.015	7
17	0.011	4
Total samples		177

(4) D16S539

Chromosomal location: 16q24-qter

GenBank locus and locus definition: NA

Repeat sequence 5'-3': (AGAT)n (SEQ ID NO:3)

Allelic ladder size range (bases): 264-304

STR ladder size range (# of repeats): 5, 8, 9, 10, 11, 12, 13, 14, 15

Promega K562 DNA™ Allele sizes (# of repeats): 11/12

PCR protocol:

Thermal cycler:	DNA Technology Ltd., Russia
Initial Incubation:	95° C., 2'
Cycling for 30 cycles:	
Denaturation	94° C., 45"
Primer linking	64° C., 30"
Elongation	72° C., 30"
Extension step:	72° C., 5'
Hold step:	4° C., unlimited time

The analysis has been done as described in GenePrint™ STR Systems (Silver Stain Detection) Technical Manual No. D004. Promega Corporation, Madison, Wis. USA: 1993-2001. See Table 7.

TABLE 7

Allele Frequencies for Caucasian-Americans		
Allele	Allele frequency	Number of Alleles observed
6	0.000	0
7	0.000	0
8	0.026	11
9	0.107	45
10	0.079	33
11	0.319	134
12	0.269	113
13	0.167	70
14	0.031	13
15	0.002	1
Homozygotes		57
Heterozygotes		153
Total samples		210

(5) D7S820

Chromosomal location: 7q11.21-22

GenBank locus and locus definition: NA

Repeat sequence 5'-3': (AGAT)n (SEQ ID NO:4)

Allelic ladder size range (bases): 215-247

VNTR ladder size range (# of repeats): 6, 7, 8, 9, 10, 11, 12, 13, 14

Promega K562 DNA® Allele sizes (# of repeats): 9/11

PCR protocol:

Thermal cycler:	DNA Technology Ltd., Russia
Initial Incubation:	95° C., 2'
Cycling for 30 cycles:	
Denaturation	94° C., 45"
Primer linking	64° C., 30"
Elongation	72° C., 30"
Extension step:	72° C., 5'
Hold step:	4° C., unlimited time

analysis has been done as described in GenePrint® STR Systems (Silver Stain Detection) Technical Manual No. D004. Promega Corporation, Madison, Wis. USA: 1993-2001. See Table 8.

TABLE 8

Allele Frequencies for D7S820 in Different Populations				
Allele	Allele frequency for Caucasian-Americans	Number of Alleles observed	Allele frequency for Russians	Number of Alleles observed
6	0.002	1	0.0012	1
7	0.010	4	0.0087	7
8	0.155	65	0.1928	155
9	0.152	64	0.1480	119
10	0.295	124	0.2524	203
11	0.195	82	0.2040	164
12	0.121	51	0.1580	127
13	0.057	24	0.0299	24
14	0.012	5	0.0050	4
Homozygotes	43		92	
Heterozygotes	167		310	
Total samples	210		402	

(6) Human von Willebrand factor gene hypervariable microsatellite locus II (vWFII)
Chromosomal location: 12p13.3-12p13.2
GenBank locus and locus definition: HUMvWFII, Human von Willebrand factor gene
Repeat sequence 5'-3': (ATCT)n/(AGAT)n (SEQ ID NO'S 3&5)
Allelic ladder size range (bases): 154-178
STR ladder size range (# of repeats): 9, 11, 12, 13
Other known alleles (# of repeats): 8, 10, 14, 15
Promega K562 DNA® Allele sizes (# of repeats): 13/13
PCR protocol:

Thermal cycler:	DNA Technology Ltd., Russia
Initial Incubation:	95° C., 2'
Cycling for 30 cycles:	
Denaturation	94° C., 1'
Elongation and primer linking	60° C., 2'
Extension step:	72° C., 5'
Hold step:	4° C., unlimited time

The analysis has been done as described in Efremov et al. (An expert evaluation of molecular genetic individualizing systems based on the HUMvWFII and D6S366 tetranucleotide tandem repeats. Sud Med Ekspert (1998) 41(2):33-36). See Table 9.

TABLE 9

Allele Frequencies for Russian Populations

Allele	Allele frequency	Number of Alleles observed
9	0.082	37
10	0.088	40
11	0.392	177
12	0.296	134
13	0.069	31
14	0.058	26
15	0.015	7
Total samples	226	

(7) D13S317
Chromosomal location: 13q22-q31
GenBank locus and locus definition: NA
Repeat sequence 5'-3': (AGAT)n (SEQ ID NO:3)
Allelic ladder size range (bases): 165-197
STR ladder size range (# of repeats): 8, 9, 10, 11, 12, 13, 14, 15
Other known alleles (# of repeats): 7
Promega K562 DNA® Allele sizes (# of repeats): 8/8
PCR protocol:

Thermal cycler:	DNA Technology Ltd., Russia
Initial Incubation:	95° C., 2'
Cycling for 30 cycles:	
Denaturation	94° C., 45"
Primer linking	64° C., 30"
Elongation	72° C., 30"
Extension step:	72° C., 5'.
Hold step:	4° C., unlimited time

The analysis has been done as described in GenePrint® STR Systems (Silver Stain Detection) Technical Manual No. D004. Promega Corporation, Madison, Wis. USA: 1993-2001. See Table 10.

TABLE 10

Allele Frequencies for D13S317 in Different Populations

Allele	Allele frequency for Caucasian-Americans	Number of Alleles observed	Allele frequency for Russians	Number of Alleles observed
7	0.000	0	0	0
8	0.143	60	0.1393	112
9	0.052	22	0.0883	71
10	0.052	22	0.0684	55
11	0.305	128	0.3706	298
12	0.307	129	0.2040	164
13	0.083	35	0.0871	70
14	0.057	24	0.0423	34
15	0.000	0	0	0
Homozygotes	61		90	
Heterozygotes	149		312	
Total samples	210		402	

(8) Human von Willebrand factor gene hypervariable microsatellite locus (vWA)

Chromosomal location: 12p 12pter

GenBank locus and locus definition: HUMVWFA31, Human von Willebrand factor gene

Repeat sequence 5'-3': (AGAT)n (SEQ ID NO:7)

Allelic ladder size range (bases): 139-167

STR ladder size range (# of repeats): 14, 16, 17, 18

Other known alleles (# of repeats): 11, 12, 13, 15, 19, 20, 21

Promega K562 DNA® Allele sizes (# of repeats): 16/16

PCR protocol:

Thermal cycler:	DNA Technology Ltd., Russia
Initial Incubation:	95° C., 2'
Cycling for 30 cycles:	
Denaturation	94° C., 1'
Elongation and primer linking	60° C., 2'
Extension step:	72° C., 5'
Hold step:	4° C., unlimited time

The analysis has been done as described in GenePrint® STR Systems (Silver Stain Detection) Technical Manual No. D004. Promega Corporation, Madison, Wis. USA: 1993-2001. See Table 11.

TABLE 11

Allele Frequencies for HUMVWFA31 in Different Populations

Allele	Allele frequency for Caucasian-Americans	Number of Alleles observed	Allele frequency for Russians	Number of Alleles observed
13	0.000	0	0.0025	2
14	0.131	56	0.0796	64
15	0.082	35	0.0920	74
16	0.211	90	0.2127	171
17	0.265	113	0.2836	228
18	0.202	86	0.2251	181
19	0.087	37	0.0833	67
20	0.021	9	0.0199	16
21	0.000	0	0.0012	1
Homozygotes		38		70
Heterozygotes		175		332
Total samples		213		402

(9) Human c-fms proto-oncogene for CSF-1 receptor gene microsatellite locus (CSF1PO)

Chromosomal location: 5q33.3-34

GenBank locus and locus definition: HUMCSF1PO, Human c-fms proto-oncogene

Repeat sequence 5'-3': (AGAT)n (SEQ ID NO:3)

Allelic ladder size range (bases): 295-327

STR ladder size range (# of repeats): 7, 8, 9, 10, 11, 12, 13, 14, 15

Other known alleles (# of repeats): 6

Promega K562 DNA® Allele sizes (# of repeats): 9/10

PCR protocol:

Thermal cycler:	DNA Technology Ltd., Russia
Initial Incubation:	95° C., 2'
Cycling for 30 cycles:	
Denaturation	94° C., 45"
Primer linking	64° C., 30"
Elongation	72° C., 30"
Extension step:	72° C., 5'
Hold step:	4° C., unlimited time

The analysis has been done as described in GenePrint® STR Systems (Silver Stain Detection) Technical Manual No. D004. Promega Corporation, Madison, Wis. USA: 1993-2001. See Table 12.

TABLE 12

Allele Frequencies for Caucasian-Americans

Allele	Allele frequency	Number of Alleles observed
6	0.000	0
7	0.000	0
8	0.002	1
9	0.033	14
10	0.251	108
11	0.309	133
12	0.330	142
13	0.060	26
14	0.014	6
15	0.000	0

TABLE 12-continued

Allele Frequencies for Caucasian-Americans

Allele	Allele frequency	Number of Alleles observed
Homozygotes		47
Heterozygotes		168
Total samples		215

(10) Human thyroid peroxidase gene microsatellite locus (TPOX)

Chromosomal location: 2p25.1-pter

GeneBank locus and locus definition: HUMTPOX, Human thyroid peroxidase gene

Repeat sequence 5'-3': (AATG)n (SEQ ID NO:7)

Allelic ladder size range (bases): 224-252

STR ladder size range (# of repeats): 6, 7, 8, 9, 10, 11, 12, 13

Other known alleles (# of repeats): none

Promega K562 DNA® Allele sizes (# of repeats): 8/9

PCR protocol:

Thermal cycler:	DNA Technology Ltd., Russia
Initial Incubation:	95° C., 2'
Cycling for 30 cycles:	
Denaturation	94° C., 45"
Primer linking	64° C., 30"
Elongation	72° C., 30"
Extension step:	72° C., 5'
Hold step:	4° C., unlimited time

The analysis has been done as described in GenePrint® STR Systems (Silver Stain Detection) Technical Manual No. D004. Promega Corporation, Madison, Wis. USA: 1993-2001. See Table 13.

TABLE 13

Allele Frequencies for Caucasian-Americans

Allele	Allele frequency	Number of Alleles observed
6	0.002	1
7	0.000	0
8	0.528	227
9	0.093	40
10	0.056	24
11	0.284	122
12	0.037	16
13	0.000	0
Homozygotes		76
Heterozygotes		139
Total samples		215

(11) Human tyrosine hydroxylase gene microsatellite locus (TH01)

Chromosomal location: 5q33.3-34

GenBank locus and locus definition: HUMTHO1, Human tyrosine hydroxylase gene

Repeat sequence 5'-3': (AATG)n (SEQ ID NO:8)

Allelic ladder size range (bases): 179-203

STR ladder size range (# of repeats): 5, 6, 7, 8, 9, 10, 11

Other known alleles (# of repeats): 9.3

Promega K562 DNA® Allele sizes (# of repeats): 9.3/9.3

PCR protocol:

Thermal cycler:	DNA Technology Ltd., Russia
Initial Incubation:	95° C., 2'
Cycling for 30 cycles:	
Denaturation	94° C., 45"
Primer linking	64° C., 30"
Elongation	72° C., 30"
Extension step:	72° C., 5'
Hold step:	4° C., unlimited time

The analysis has been done as described in GenePrint® STR Systems (Silver Stain Detection) Technical Manual No. D004. Promega Corporation, Madison, Wis. USA: 1993-2001. See Table 14.

TABLE 14

Allele Frequencies for Caucasian-Americans

Allele	Allele frequency	Number of Alleles observed
5	0.007	3
6	0.237	101
7	0.148	63
8	0.117	50
9	0.155	66
9.3	0.331	141
10	0.005	2
11	0.000	0
Homozygotes		50
Heterozygotes		163
Total samples		213

Results

The hES cells from this method display many features that are typical for embryonic stem cells: cytoplasmic lipid bodies, small cytoplasmic/nuclear ratio and clearly distinguishable nucleoli. The hES cell colonies display similar morphology to that reported previously for human embryonic stem cells derived after in vitro fertilization. The cells were immunoreactively positive for alkaline phosphatase (FIG. **1**A), octamer-binding transcription factor 4 mRNA (Oct-4) (FIG. **1**B), stage-specific embryonic antigen 1 (SSEA-1) (FIG. **1**C), stage-specific embryonic antigen 3 (SSEA-3) (FIG. **1**D), stage-specific embryonic antigen 4 (SSEA-4) (FIG. **1**E), tumor rejection antigen 1-60 (TRA-1-60) (FIG. **1**F), tumor rejection antigen 1-81 (TRA-1-81) (FIG. **1**G), and negative for stage-specific embryonic antigen 1 (SSEA-1) (FIG. **1**C), (which is positive for mouse embryonic stem cells, but not for human). Telomerase activity is often correlated with replicative immortality and is typically expressed in germ cells, cancer cells, and a variety of stem cells, including stem cells, but absent in most somatic cell types. The cells prepared by this method after three months in in vitro proliferation maintained their undifferentiated morphology and displayed high levels of telomerase activity (FIG. **2**A). The pluripotency of the cells was investigated in vitro by embryoid body formation (FIGS. **2**B, **2**C), G-banded karyotyping shows that cells have normal human 46XX karyotype (FIG. **2**D).

DNA fingerprinting analysis was performed on the blood of the oocyte donor, on the ES cells, and on the HNSF feeder cells by Southern blotting and hybridization with a ^{32}P-labeled (CAC)s oligonucleotide probe (FIG. **2**E), and monolocus polymerase chain reaction (PCR) with different locuses.

For monolocus PCR, genotyping revealed identical alleles for all loci (but one, D7S820) between blood (donor) DNA and OL1 DNA. See Table 15.

TABLE 15

Monolocus PCR genotyping.

NN	Locus definition	Chromosomal location	hES	NSF	Blood
1.	3'ApoB	2p24-p23	36/48	36/36	36/48
2.	D1S80	1p35-36	18/24	22/31	18/24
3.	D6S366	6q21-qter	13/15	17/17	13/15
4.	D16S359	16q24-qter	8/13	12/13	8/13
5.	D7S820	7q11.21-22	11/11	9/10	10/11
6.	vWFII	12p13.3-12p13.2	11/13	9/11	11/13

TABLE 15-continued

Monolocus PCR genotyping.

NN	Locus definition	Chromosomal location	hES	NSF	Blood
7.	D13S317	13q22-q31	9/12	11/12	9/12
8.	vWA	12p12pter	14/18	17/18	14/18
9.	CSF1PO	5q33.3-34	12/12	12/13	12/12
10.	TPOX	2p25.1-pter	8/11	8/11	8/11
11.	TH01	5q33.3-34	6/6	6/9.3	6/6

Heterozygosity (heterozygosis) of all heterozygous donor loci (but one, D7S820) was not changed in hES loci. Homozygosity (homozygosis) of D7S820 locus in hES DNA is a result of mutation (insertion of one AGAT monomer in microsatellite repeat) due to slipped-strand mispairing during DNA replication and DNA repair.

These results are in accordance with those obtained with multilocus DNA fingerprinting (when substantially identical fingerprint patterns for donor DNA and hES DNA were found).

FIG. **2**E demonstrated heterozygosity of hES cells and their identity with the oocyte donor's blood, and there was no similarity between the hES cells and the feeder cells. The DNA profile of hES cell line was confirmed by PCR-based haplotype analysis using polymorphic genes within the MHC class I and class II. Total genomic DNA from the oocyte donor blood cells, from hES cells, and feeder HNSFs were genotyped and compared. The data demonstrated that hES cells and cells from donor blood were indistinguishable from each other and therefore should be considered autologous, and both distinguished from DNA of the feeder cells (Table 16).

TABLE 16

HLA Typing.

	MHC I			MHC II		
	HLA-A	HLA-B	HLA-C	DRB1	DQB1	DQA1
pHES-1	A*01	B*15(63)	Cw*04	DRB1*12	DQB1*06	DQA1*01
	A*02	B*35	Cw*0708	DRB1*13	DQB1*03	DQA1*0505
Donor	A*01	B*15(63)	Cw*04	DRB1*12	DQB1*06	DQA1*01
	A*02	B*35	Cw*0708	DRB1*13	DQB1*03	DQA1*0505
HNSF	A*25	B*15(62)	Cw*12	DRB1*04	DQB1*06	DQA1*01
	A*32	B*18	Cw*12	DRB1*15	DQB1*03	DQA1*03

DNA fingerprinting and HLA typing analysis confirmed that the hES cells are heterozygous and contain the whole donor genetic material. These results coincide with data from parthenogenetic monkey stem cell lines (Vrana et al., Proc Natl Acad Sci USA (2003) 100(Suppl 1): 11911-11916), and do not coincide with data from parthenogenetic mouse stem cell lines (Lin et al., Stem Cells (2003) 21:153-161), which contains half of the donor genetic material.

The phESC lines display a morphology expected in hES cells, forming colonies with tightly packed cells, prominent nucleoli and a small cytoplasm to nucleus ratio (FIG. **4**). These cells express traditional hES markers SSEA-3, SSEA-4, TRA-1-60, TRA-1-81, and OCT-4, and do not express SSEA-1, a positive marker for undifferentiated mouse embryonic stem cells (FIG. **4**). The cells derived from all lines demonstrate high levels of alkaline phosphatase and telomerase activity (FIG. **5** and FIG. **6**). G-banded karyotyping showed that phESC lines have a normal human 46,XX karyotype, with the exception of the phESC-7 line (FIG. **7**). Approximately 91% of cells from the phESC-7 line have a 47,XXX karyotype and 9% of the cells have a 48,XXX,+6 karyotype. A different degree of X chromosome heteromorphism was observed in the lines; approximately 12% of the phESC-1 and phESC-6 lines; 42% for the phESC-5 line; and 70, 80, and 86% for the cell lines phESC7, phESC-3, and phESC-4, respectively (FIG. **7**).

Comparative DNA profiling of was performed on all the phESC lines, the donor somatic cells and the feeder cells. These studies used Affimetrix SNP microarrays (Mapping 50K Hind 240 Arrays) to study chromosome changes and to confirm the genetic similarity of the phESC to the donor's somatic cells. All paired genotype relationships between phESC lines and their associated donor somatic cells were identified as "full siblings", and all other combinations of pairs were identified as "unrelated". Internal controls identified the paired genotype relationship between split cultures derived from the same phESC line as "monozygotic twins" (Table 17, Database S1).

TABLE 17

Database S1.
Database S1 Identifying DNA samples from phESC and related donors

genotype 1	genotype 2	putative relationship	inferred relationship	IBS 0	IBS 1	IBS 2	n_typed	MZtwins	LOD par/off	LOD fullsibs	LOD halfsibs	LOD unrelated
1	2	unrelated	unrelated	166	662	631	1459	−1503.03	−300.45	−23.15	−8.41	0
1	3	unrelated	unrelated	241	616	602	1459	−1560.65	−434.85	−28.04	−12.22	0
1	4	unrelated	unrelated	225	623	611	1459	−1535.94	−400.61	−31.39	−14.39	0
1	5	unrelated	unrelated	225	623	611	1459	−1535.94	−400.61	−31.39	−14.39	0
1	6	unrelated	unrelated	243	644	572	1459	−1642.35	−445.78	−31.74	−14.54	0
1	7	unrelated	unrelated	252	638	569	1459	−1641.11	−453.5	−29.25	−12.86	0
1	8	unrelated	unrelated	250	643	566	1459	−1656.02	−460.02	−32.86	−15.32	0
1	9	unrelated	unrelated	219	657	583	1459	−1605.31	−382.39	−27.37	−11.58	0
1	10	unrelated	unrelated	158	707	594	1459	−1591.43	−279.21	−26.37	−10..89	0
1	11	unrelated	unrelated	193	668	598	1459	−1584.71	−354.76	−29.65	−13..31	0
1	12	unrelated	unrelated	166	671	622	1459	−1523.1	−300.5	−30.53	−13..92	0
2	3	unrelated	full sibs	0	282	1177	1459	−440.02	−146.3	0	−167.42	−363.63
2	4	unrelated	unrelated	233	627	599	1459	−1569.66	−423.24	−28.24	−12.91	0
2	5	unrelated	unrelated	233	627	599	1459	−1569.66	−423.24	−28.24	−12.91	0
2	6	unrelated	unrelated	217	650	592	1459	−1584.75	−388.44	−22.62	−8.53	0
2	7	unrelated	unrelated	243	650	566	1459	−1645.94	−437.91	−23.23	−8.72	0
2	8	unrelated	unrelated	225	649	585	1459	−1603.18	−404.41	−27.04	−11.97	0
2	9	unrelated	unrelated	210	639	610	1459	−1532.75	−360.46	−24.72	−9.89	0
2	10	unrelated	unrelated	144	683	632	1459	−1491.18	−243.56	−16.82	−4.51	0
2	11	unrelated	unrelated	172	680	607	1459	−1556.46	−310.03	−23.5	−9.7	0
2	12	unrelated	unrelated	176	667	616	1459	−1538.57	−327.95	−27.31	−12..06	0
3	4	unrelated	unrelated	336	457	666	1459	−1391.57	−599.92	−30.6	−14.62	0
3	5	unrelated	unrelated	336	457	666	1459	−1391.57	−599.92	−30.6	−14.62	0
3	6	unrelated	unrelated	322	482	655	1459	−1415.98	−571.23	−26.08	−11.86	0
3	7	unrelated	unrelated	369	442	648	1459	−1432.05	−664.95	−27.39	−11.93	0
3	8	unrelated	unrelated	334	483	642	1459	−1449.86	−597.75	−31.68	−15.14	0
3	9	unrelated	unrelated	307	493	659	1459	−1395.19	−530.45	−24.56	−10	0
3	10	unrelated	unrelated	215	623	621	1459	−1503.92	−364.97	−17.26	−4.43	0
3	11	unrelated	unrelated	264	582	613	1459	−1531.91	−473.48	−28.41	−12..81	0
3	12	unrelated	unrelated	254	595	610	1459	−1544.73	−460.57	−29.92	−13..88	0
4	5	unrelated	MZ twins	0	0	1459	1459	0	−379.58	−45.47	−401.67	−677.74
4	6	unrelated	unrelated	334	475	650	1459	−1436.59	−599.55	−32.73	−15.19	0
4	7	unrelated	unrelated	365	439	655	1459	−1418.34	−656.01	−31.6	−14.56	0
4	8	unrelated	unrelated	329	486	644	1459	−1450.75	−586.4	−32.06	−14.88	0
4	9	unrelated	unrelated	332	466	661	1459	−1395.18	−590.12	−28.69	−12.94	0
4	10	unrelated	unrelated	245	606	608	1459	−1542.32	−438.93	−28.75	−12..74	0
4	11	unrelated	unrelated	273	569	617	1459	−1530.97	−492.84	−29.03	−12..34	0
4	12	unrelated	full sibs	0	224	1235	1459	−326.17	−162.34	0	−183.44	−393.46
5	6	unrelated	unrelated	334	475	650	1459	−1436.59	−599.55	−32.73	−15.19	0
5	7	unrelated	unrelated	365	439	655	1459	−1418.34	−656.01	−31.6	−14.56	0
5	8	unrelated	unrelated	329	486	644	1459	−1450.75	−586.4	−32.06	−14.88	0
5	9	unrelated	unrelated	332	466	661	1459	−1395.18	−590.12	−28.69	−12.94	0
5	10	unrelated	unrelated	245	606	608	1459	−1542.32	−438.93	−28.75	−12..74	0
5	11	unrelated	unrelated	273	569	617	1459	−1530.97	−492.84	−29.03	−12..34	0
5	12	unrelated	full sibs	0	224	1235	1459	−326.17	−162.34	0	−183.44	−393.46
6	7	unrelated	full sibs	45	176	1238	1459	−277.78	−217.21	0	−165.72	−390.62
6	8	unrelated	full sibs	44	187	1228	1459	−289.8	−201.32	0	−153.75	−365.51
6	9	unrelated	unrelated	333	481	645	1459	−1436.5	−595.4	−30.3	−13.77	0
6	10	unrelated	unrelated	240	601	618	1459	−1518.17	−425.03	−27.11	−11..53	0
6	11	unrelated	full sibs	0	164	1295	1459	−209.27	−191.66	0	−213.25	−440.56
6	12	unrelated	unrelated	234	615	610	1459	−1547.15	−416.14	−30.21	−13..64	0
7	8	unrelated	full sibs	38	225	1196	1459	−326.62	−150.16	0	−121.55	−334.09
7	9	unrelated	unrelated	359	473	627	1459	−1479.28	−642.41	−30.61	−14.47	0
7	10	unrelated	unrelated	252	623	584	1459	−1598.35	−443.81	−28.88	−13..09	0
7	11	unrelated	full sibs	0	230	1229	1459	−318.49	−137.93	0	−159.55	−389.58
7	12	unrelated	unrelated	265	583	611	1459	−1539.33	−472.91	−30.55	−13..87	0
8	9	unrelated	unrelated	347	480	632	1459	−1472.41	−625.68	−30.93	−14.31	0
8	10	unrelated	unrelated	244	614	601	1459	−1561.3	−434	−28.07	−12..37	0
8	11	unrelated	full sibs	0	175	1284	1459	−223.73	−178.56	0	−200.12	−428.04
8	12	unrelated	unrelated	236	610	613	1459	−1539.08	−417.14	−29.32	−13..14	0
9	10	unrelated	full sibs	0	228	1231	1459	−315.15	−152.88	0	−174.27	−392.91
9	11	unrelated	unrelated	269	567	623	1459	−1502.69	−479.57	−28.47	−12..55	0
9	12	unrelated	unrelated	245	612	602	1459	−1557.25	−438.53	−26.07	−11..15	0

TABLE 17-continued

Database S1.
Database S1 Identifying DNA samples from phESC and related donors

genotype 1	genotype 2	putative relationship	inferred relationship	IBS 0	IBS 1	IBS 2	n_typed	MZtwins	LOD par/off	LOD fullsibs	LOD halfsibs	LOD unrelated
10	11	unrelated	unrelated	187	635	637	1459	−1478.7	−328.06	−25.52	−10.6	0
10	12	unrelated	unrelated	181	662	616	1459	−1534.36	−329	−25.2	−10.6	0

DNA samples were numbered as follows: 1-human neonatal skin fibroblasts; 2-phESC-7 line donor; 3-phESC-7 line; 4-phESC-1 line; 5-phESC-1 line; 6-phESC-3 line; 7-phESC-4 line; 8-phESC-5 line; 9-phESC-6 line; 10-phESC-6 line donor; 11-phESC-3 to phESC-5 lines donor; and 12-phESC-1 line donor.

The result shows that only one pair (sample 4-5), has been identified as monozygotic (MZ) twins. Ten other pairs (samples 2-3, 4-12, 5-12, 6-7, 6-11, 7-8, 7-11, 8-11, 9-10) have been identified as full siblings, and all the other combination of pairs have been identified as unrelated. The IBS columns in the output display the number of markers at which the pair are both typed and share 0, 1, or 2 alleles identical by state (For MZ twins under ideal conditions of no genotyping errors, all markers must be placed under IBS = 2). The output does not display P (observed markers | given relationship) directly, but it displays LOD score —$\log_{10}$ {P(observed markers | putative relationship/P(observed markers | relationship for which maximum likelihood was obtained and thus the call was made)} as a measure of similarity. The smaller the LOD score is, the less likely the putative relationship between two samples it.

Comparative analysis of 1,459 SNP markers revealed phESC heterozygosity and showed that changes had occurred in the phESC cell genotype in comparison to the related donor somatic cell genotype. Some segments of the somatic cell genome that had formerly been heterozygous became homozygous in the related phESC line genome. This heterozygous to homozygous pattern occurred in 11-15% of the phESC-1, PhESC-3, phESC-4, phESC-5 and phESC-6 lines, and was 19% for the phESC7 line (Database S2). Moreover, genetic differences were observed between the phESC and phESC-5 lines that had been derived from the same oocyte donor (Table 18, Database S2).

TABLE 18

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromosome	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
1	SNP_A-1697748	rs10752719	3744122	3.744122	0.436	AB	AB	BB	AB	AB	AB	BB	BB	BB	BB
1	SNP_A-1743594	rs806104	5977200	5.9772	0.631	AB	AB	AA	AB	AB	AB	AB	AB	AA	AA
1	SNP_A-1687843	rs301791	8402638	8.402638	0.274	AB	AB	BB	BB	BB	BB	AB	AB	AA	AB
1	SNP_A-1647681	rs1474868	11978430	11.97843	0.333	BB	BB	AA	AA	AA	AA	AA	AA	AA	AA
1	SNP_A-1673737	rs1417144	14211391	14.211391	0.548	AA	AA	AB	AB	AB	AB	AA	AA	AB	AB
1	SNP_A-1747116	rs860379	18414756	18.414756	0.25	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
1	SNP_A-1662223	rs10492997	19514677	19.514677	0.631	AA	AA	BB	BB	BB	BB	AB	AB	AA	AA
1	SNP_A-1662225	rs559346	28077956	28.077956	0.583	BB	AB	AB	AB	AB	AB	AB	AB	AA	AB
1	SNP_A-1646469	rs4949455	31783886	31.783886	0.382	AA	AB	AB	BB	AB	AB	AB	AB	AA	AA
1	SNP_A-1695076	rs6661190	33872782	33.872782	0.274	BB	BB	BB	BB	BB	BB	BB	BB	BB	AB
1	SNP_A-1679571	rs4653029	34558585	34.558585	0.274	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
1	SNP_A-1675060	rs7531479	36798680	36.79868	0.714	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
1	SNP_A-1753902	rs1010805	37858235	37.858235	0.738	AA	AA	AB	AA	BB	AB	AA	AA	BB	BB
1	SNP_A-1691977	rs6693076	39972196	39.972196	0.441	AA	AA	AB	AA	BB	AB	AB	AB	BB	BB
1	SNP_A-1723259	rs407752	40472948	40.472948	0.333	BB	BB	AB	AA	BB	AB	BB	BB	BB	BB
1	SNP_A-1692103	rs7515340	41055964	41.055964	0.381	AB	AB	AA	AA	AA	AA	AA	AA	BB	BB
1	SNP_A-1696731	rs4660575	41902429	41.902429	0.429	BB	BB	BB	BB	BB	BB	AA	AA	BB	AB
1	SNP_A-1701070	rs1408412	42787470	42.78747	0.679	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
1	SNP_A-1729559	rs1771551	45552736	45.552736	0.738	AA	AA	AA	AA	AA	AA	AA	AA	BB	AB

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
1	SNP_A-1670587	rs2245122	47358015	47.358015	0.598	AA	AA	AA	AA	AA	AA	BB	BB	BB	AB
1	SNP_A-1711898	rs1875645	50501900	50.5019	0.524	AB	AB	BB	BB	BB	BB	BB	BB	BB	BB
1	SNP_A-1645411	rs625643	54349188	54.349188	0.25	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
1	SNP_A-1718210	rs10493206	56531172	56.531172	0.488	AA	AA	BB	BB	BB	BB	AB	AB	AA	AB
1	SNP_A-1752670	rs1831870	57339224	57.339224	0.524	AB	AB	AB	AA	BB	AB	BB	BB	BB	AB
1	SNP_A-1669308	rs852766	57998529	57.998529	0.564	AA	AA	AA	AA	AA	AA	AA	AA	BB	AB
1	SNP_A-1681141	rs1969772	58917123	58.917123	0.738	AA	AA	AA	AA	AA	AA	AB	AB	AA	AB
1	SNP_A-1690420	rs10489908	61576784	61.576784	0.738	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
1	SNP_A-1727043	rs2765249	62441479	62.441479	0.75	AA	AA	AA	AA	AA	AA	BB	BB	AA	AB
1	SNP_A-1646105	rs3861943	63439667	63.439667	0.405	BB	BB	BB	BB	BB	BB	AB	AB	AA	AB
1	SNP_A-1654674	rs592298	64000081	64.000081	0.25	BB	BB	BB	BB	BB	BB	AB	AB	BB	AB
1	SNP_A-1708628	rs746633	64503887	64.503887	0.692	AA	AA	BB	BB	BB	BB	BB	BB	AA	AB
1	SNP_A-1713897	rs1171279	65700514	65.700514	0.345	BB	BB	BB	BB	BB	BB	BB	BB	BB	AB
1	SNP_A-1717648	rs1280310	66928844	66.928844	0.655	AB	AB	AB	BB	AA	AB	AB	AB	AA	AB
1	SNP_A-1712508	rs1408956	67849084	67.849084	0.536	AB	AB	AB	AA	BB	AB	AB	AB	BB	BB
1	SNP_A-1688631	rs1413953	70834525	70.834525	0.571	AB	AB	AA	AA	AA	AA	AB	AB	AA	AB
1	SNP_A-1720162	rs1338655	73569634	73.569634	0.429	AB	AB	AA	AA	AA	AA	AA	AA	BB	BB
1	SNP_A-1697494	rs10493539	74427598	74.427598	0.25	AA	AA	BB	BB	BB	BB	BB	BB	AA	AB
1	SNP_A-1649261	rs277355	75002805	75.002805	0.345	BB	BB	BB	BB	BB	BB	AB	AB	BB	AB
1	SNP_A-1744876	rs1250876	75905253	75.905253	0.345	AB	AB	AB	BB	AA	AB	AB	AB	BB	BB
1	SNP_A-1739854	rs3928852	76926021	76.926021	0.607	AA	AA	AA	AA	AA	AA	AB	AB	AA	AA
1	SNP_A-1687047	rs10493596	77438262	77.438262	0.718	AA	AA	AA	AA	AA	AA	AB	AB	AA	AA
1	SNP_A-1732619	rs1248480	79071260	79.07126	0.357	BB	BB	AA	AA	AA	AA	AB	AB	BB	BB
1	SNP_A-1664985	rs2127436	79792017	79.792017	0.488	AB	AB	AB	BB	AA	AB	BB	BB	AA	AB
1	SNP_A-1644541	rs2389016	80511350	80.51135	0.738	AA	AA	AB	BB	AA	AB	AB	AB	AA	AB
1	SNP_A-1645927	rs10518660	82094088	82.094088	0.738	AB	AB	AA	AA	AA	AA	AA	AA	AA	AA
1	SNP_A-1693780	rs6598991	82697988	82.697988	0.524	BB	BB	AB	AA	AB	AB	AA	AA	AA	AA
1	SNP_A-1674234	rs2268667	85505767	85.505767	0.321	BB	BB	AB	AA	AB	AB	BB	BB	BB	AB
1	SNP_A-1752288	rs306322	88673430	88.67343	0.726	AA	AA	AA	AA	AA	AA	AB	AB	BB	AB
1	SNP_A-1736094	rs1831298	90211840	90.21184	0.262	AB	AB	BB	BB	BB	BB	AA	AA	BB	AB
1	SNP_A-1711115	rs4233429	90811924	90.811924	0.25	BB	BB	AB	BB	AB	AB	BB	BB	BB	BB
1	SNP_A-1714794	rs665484	91375951	91.375951	0.512	AB	AB	AA	AA	AA	AA	AA	AA	BB	BB
1	SNP_A-1675488	rs490800	92304926	92.304926	0.369	BB	BB	AB	BB	AB	AB	AB	AB	BB	AB
1	SNP_A-1656572	rs6703310	93500761	93.500761	0.393	AB	AB	AB	AA	AB	AB	BB	BB	BB	BB
1	SNP_A-1755223	rs223237	96276742	96.276742	0.476	BB	BB	BB	BB	BB	BB	AA	AA	AA	AA
1	SNP_A-1691383	rs1911500	98291841	98.291841	0.738	AA	AA	AA	AA	AA	AA	AB	AB	AA	AB

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
1	SNP_A-1725993	rs1838587	101983453	101.983453	0.525	AA	AA	AB	AA	AB	AB	AB	AB	AA	AB
1	SNP_A-1689489	rs7521799	102944538	102.944538	0.619	BB	BB	AB	AA	AB	AB	AA	AB	BB	BB
1	SNP_A-1684273	rs1576516	104210964	104.210964	0.452	AB	AB	AA	AA	AA	AA	BB	BB	AA	AA
1	SNP_A-1733369	rs1919894	107240697	107.240697	0.381	BB	BB	BB	BB	BB	BB	AA	AB	BB	BB
1	SNP_A-1715038	rs10494081	108114145	108.114145	0.667	AA	AA	AA	AA	AA	AA	AA	AB	BB	AB
1	SNP_A-1699288	rs2026485	108978565	108.978565	0.333	BB	BB	AB	BB	AB	AB	BB	BB	BB	AB
1	SNP_A-1750726	rs6682717	110527665	110.527665	0.441	AA	AA	AB	BB	AB	AB	AA	AB	AA	AA
1	SNP_A-1648811	rs694180	111438255	111.438255	0.464	AB	AB	BB	BB	BB	BB	BB	BB	AA	AB
1	SNP_A-1753842	rs1936061	112187978	112.187978	0.595	AA	AA	AA	AA	AA	AA	BB	AB	BB	BB
1	SNP_A-1689065	rs2359417	113685242	113.685242	0.452	BB	BB	BB	BB	BB	BB	AA	AB	BB	BB
1	SNP_A-1746401	rs3767824	118152606	118.152606	0.429	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
1	SNP_A-1688653	rs1766803	119095860	119.09586	0.366	BB	AB	BB	BB	BB	BB	BB	BB	BB	BB
1	SNP_A-1708513	rs477992	119969618	119.969618	0.286	AA	AB	BB	BB	BB	AB	BB	BB	BB	AB
1	SNP_A-1701244	rs10494240	143040559	143.040559	0.321	AB	AB	AA	AA	AA	AA	BB	AB	AA	AB
1	SNP_A-1706430	rs10494267	148366991	148.366991	0.321	BB	BB	BB	BB	BB	BB	AB	AB	BB	BB
1	SNP_A-1680305	rs2879490	149760236	149.760236	0.381	BB	BB	BB	BB	BB	AB	AA	AA	AA	AA
1	SNP_A-1723421	rs10494303	150706096	150.706096	0.571	BB	BB	AA	AA	AA	AB	AB	AB	AA	AA
1	SNP_A-1681003	rs884664	151516798	151.516798	0.702	AA	AA	AA	AA	AA	AB	AA	AA	AA	AA
1	SNP_A-1667931	rs10494315	154072954	154.072954	0.655	AB	AB	AA	AA	AA	AB	BB	BB	BB	AB
1	SNP_A-1647211	rs919477	155585918	155.585918	0.25	BB	BB	BB	BB	BB	BB	BB	BB	BB	AB
1	SNP_A-1662451	rs1149392	157241261	157.241261	0.286	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
1	SNP_A-1695012	rs6683968	158923070	158.92307	0.571	AA	AA	BB	BB	BB	BB	AA	AA	AA	AA
1	SNP_A-1716490	rs869513	159832184	159.832184	0.607	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
1	SNP_A-1727494	rs4656422	161688624	161.688624	0.25	AB	AB	AA	AA	AB	AB	BB	BB	BB	BB
1	SNP_A-1646555	rs4657482	162563307	162.563307	0.405	AB	AB	BB	BB	BB	BB	AB	AB	BB	BB
1	SNP_A-1743854	rs2093658	164086850	164.08685	0.317	AA	AA	AA	AA	AB	AB	AA	AA	AA	AA
1	SNP_A-1681011	rs1358948	165590931	165.590931	0.31	BB	BB	BB	BB	BB	BB	AB	AB	AA	AB
1	SNP_A-1751990	rs2205848	166407951	166.407951	0.31	BB	BB	BB	BB	BB	BB	BB	BB	BB	AB
1	SNP_A-1736240	rs10494487	167046739	167.046739	0.298	AB	AB	BB	BB	BB	BB	BB	BB	BB	BB
1	SNP_A-1674510	rs3753538	168481215	168.481215	0.691	AA	AA	AA	AA	AA	AA	AA	AA	BB	AB
1	SNP_A-1719434	rs10489280	169204277	169.204277	0.488	AA	AA	BB	BB	BB	BB	AA	AA	BB	BB
1	SNP_A-1753950	rs989423	171514180	171.51418	0.75	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
1	SNP_A-1722081	rs1359587	172487558	172.487558	0.691	AB	AB	BB	BB	AB	AB	AB	AB	AA	AB
1	SNP_A-1694706	rs2861746	173128066	173.128066	0.452	AB	AB	AA	AA	AA	AA	AB	AB	BB	BB
1	SNP_A-1733825	rs2493119	175995013	175.995013	0.333	BB	BB	BB	BB	BB	BB	BB	BB	AA	AB
1	SNP_A-1671505	rs1281294	178629596	178.629596	0.714	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
1	SNP_A-1694118	rs2274984	179839103	179.839103	0.524	AB	AB	AB	BB	AB	AB	AA	AA	BB	BB
1	SNP_A-1644471	rs1184639	180355276	180.355276	0.357	BB	BB	BB	BB	BB	BB	BB	BB	BB	AB
1	SNP_A-1711261	rs2840274	180942462	180.942462	0.429	AA	AA	BB	BB	BB	BB	AA	AB	BB	BB
1	SNP_A-1706912	rs170885	181673406	181.673406	0.512	AB	AB	AA	AA	AA	AA	BB	AB	BB	AB
1	SNP_A-1703470	rs10489701	182242226	182.242226	0.595	AA	AA	AB	BB	AB	AB	AA	AA	AA	AA
1	SNP_A-1696277	rs10489756	182835425	182.835425	0.262	BB	BB	AB	AA	AB	AB	AA	AA	BB	AB
1	SNP_A-1744486	rs726706	183604111	183.604111	0.429	AB	AB	BB	BB	BB	BB	BB	BB	AA	AB
1	SNP_A-1693312	rs7543266	184360480	184.36048	0.595	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
1	SNP_A-1739170	rs6665263	185050414	185.050414	0.452	BB	BB	BB	BB	BB	BB	BB	BB	AA	AA
1	SNP_A-1726093	rs10494626	186275233	186.275233	0.464	AA	AA	BB	BB	BB	BB	BB	BB	BB	AB
1	SNP_A-1658415	rs815160	186988747	186.988747	0.427	AB	AB	AA	AA	AA	AA	AA	AA	AA	AA
1	SNP_A-1666089	rs1563191	187849406	187.849406	0.333	AB	AB	AB	BB	AB	AB	BB	BB	BB	BB
1	SNP_A-1753798	rs1338034	188358939	188.358939	0.393	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
1	SNP_A-1688981	rs4657868	190164348	190.164348	0.524	AB	AB	BB	BB	BB	BB	BB	AB	BB	BB
1	SNP_A-1723115	rs10494707	191296870	191.29687	0.357	BB	BB	BB	BB	BB	BB	AA	AB	BB	BB
1	SNP_A-1651749	rs822456	191826836	191.826836	0.439	BB	BB	BB	BB	BB	BB	BB	BB	AA	AB
1	SNP_A-1642592	rs10494728	192402426	192.402426	0.25	AB	AB	BB	BB	BB	BB	AA	AB	BB	BB
1	SNP_A-1658925	rs3762271	193802099	193.802099	0.6	AB	AB	AA	AA	AA	AA	BB	BB	AA	AB
1	SNP_A-1687705	rs1927246	195048356	195.048356	0.702	AB	AB	AB	BB	AB	AB	AA	AA	AA	AB
1	SNP_A-1725025	rs10494808	196821529	196.821529	0.548	AB	AB	AA	AA	AA	AA	BB	BB	BB	AB
1	SNP_A-1665029	rs6667172	197375495	197.375495	0.5	BB	BB	AA	AA	AA	AA	AA	AB	AA	AB
1	SNP_A-1747494	rs832174	197990176	197.990176	0.25	AA	AA	BB	BB	BB	BB	BB	BB	BB	BB
1	SNP_A-1651207	rs7555556	199822633	199.822633	0.293	AB	AB	AB	AB	AB	AB	AA	AB	BB	AB
1	SNP_A-1714962	rs10494844	200501548	200.501548	0.75	AA	AA	AA	AA	AA	AA	AA	AB	AA	AA
1	SNP_A-1724123	rs10494852	201189443	201.189443	0.655	BB	BB	BB	BB	BB	BB	AA	AB	AA	AA
1	SNP_A-1673439	rs311286	203999303	203.999303	0.286	AB	AB	BB	BB	BB	BB	BB	BB	BB	BB
1	SNP_A-1669116	rs684431	204553812	204.553812	0.381	BB	BB	AA	AB	AA	AB	BB	BB	AB	AB
1	SNP_A-1650733	rs2358452	208747444	208.747444	0.707	AA	AA	AA	AA	AA	AA	BB	BB	AA	AA
1	SNP_A-1651975	rs340840	210516282	210.516282	0.393	AB	AB	BB	BB	BB	BB	BB	BB	AA	AA
1	SNP_A-1683565	rs10494987	211525052	211.525052	0.691	AB	AB	AA	AA	AA	AA	AA	AA	AA	AA
1	SNP_A-1750462	rs10495003	212237742	212.237742	0.417	AB	AB	BB	AB	BB	AB	AA	AB	AA	AA
1	SNP_A-1683969	rs6604634	213109650	213.10965	0.524	BB	BB	AA	AA	AA	AA	BB	BB	AA	AA
1	SNP_A-1731002	rs10495045	213806233	213.806233	0.714	AA	AA	AA	AB	AA	AB	BB	BB	AB	AB
1	SNP_A-1677675	rs618171	215537693	215.537693	0.631	AB	AB	AA	AA	AA	AA	AA	AA	AB	AB
1	SNP_A-1703136	rs10495156	217494419	217.494419	0.298	BB	BB	BB	BB	BB	BB	AA	AA	AB	AB
1	SNP_A-1711849	rs1338077	218118775	218.118775	0.321	BB	BB	BB	AB	BB	AB	BB	BB	BB	BB

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
1	SNP_A-1755399	rs4481859	219121051	219.121051	0.512	AB	AB	AA	AA	AA	AA	BB	BB	BB	BB
1	SNP_A-1739524	rs10495236	221802391	221.802391	0.691	AB	AB	AA	AB	AA	AB	AB	AB	AB	AB
1	SNP_A-1710164	rs710805	225430849	225.430849	0.429	AB	AB	BB	AB	BB	AB	AB	AB	AA	AA
1	SNP_A-1688357	rs1998067	226545242	226.545242	0.298	BB	BB	AA	AA	AA	AA	BB	BB	BB	BB
1	SNP_A-1732138	rs9286801	229119361	229.119361	0.476	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
1	SNP_A-1747040	rs1892298	230387334	230.387334	0.714	AA	AA	AA	AA	AA	AA	AA	AB	AA	AA
1	SNP_A-1717898	rs2463190	232711157	232.711157	0.441	AB	AB	BB	AB	BB	AB	AA	AA	AA	AA
1	SNP_A-1710935	rs819639	233219640	233.21964	0.56	AB	AB	AA	AA	AA	AA	BB	AB	AA	AA
1	SNP_A-1755297	rs2819774	234214896	234.214896	0.691	AA	AA	AA	AA	AA	AA	BB	AB	AB	AB
1	SNP_A-1677233	rs6685861	235621137	235.621137	0.357	BB	BB	AA	AA	AA	AA	AA	AB	AA	AA
1	SNP_A-1679485	rs732160	236262770	236.26277	0.298	BB	BB	BB	BB	BB	BB	BB	BB	AB	AB
1	SNP_A-1679759	rs1039529	238918670	238.91867	0.619	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
1	SNP_A-1664943	rs879725	240732087	240.732087	0.464	BB	AB	AA	AA	AA	AA	AA	AB	AB	AB
1	SNP_A-1724627	rs1093961	241902498	241.902498	0.415	BB	AB	AB	BB	AB	AB	AA	AB	AB	AB
1	SNP_A-1672603	rs3844080	243632874	243.632874	0.655	BB	BB	AA	AA	AA	AA	BB	AB	AA	AA
2	SNP_A-1753456	rs10519439	108913	0.108913	0.274	BB	BB	BB	BB	BB	BB	AB	AB	BB	BB
2	SNP_A-1746820	rs6759198	2342478	2.342478	0.56	AA	AA	BB	BB	BB	BB	AB	AB	BB	BB
2	SNP_A-1697325	rs2119075	4395806	4.395806	0.607	AA	AA	AA	AB	AB	AB	AB	AB	AB	AB
2	SNP_A-1740868	rs963964	5206872	5.206872	0.321	BB	BB	BB	BB	BB	BB	BB	BB	AB	AB
2	SNP_A-1677893	rs1429220	5881639	5.881639	0.369	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
2	SNP_A-1650909	rs6727796	7605796	7.605796	0.512	BB	BB	AA	AA	AA	AA	BB	BB	AB	AB
2	SNP_A-1663651	rs9287698	8437894	8.437894	0.281	BB	BB	BB	BB	BB	BB	AB	AB	AA	AA
2	SNP_A-1647101	rs2271333	9323848	9.323848	0.5	AB	AB	AA	AA	AA	AA	BB	BB	BB	BB
2	SNP_A-1717786	rs2241113	10226344	10.226344	0.31	BB	BB	AB	AB	AB	AB	BB	AB	BB	BB
2	SNP_A-1706150	rs1686426	10899146	10.899146	0.5	BB	BB	AB	AB	AB	AB	BB	BB	BB	BB
2	SNP_A-1676173	rs4669806	12151350	12.15135	0.619	BB	BB	AA	AA	AA	AA	AA	AA	AB	AB
2	SNP_A-1664687	rs625842	12779571	12.779571	0.583	BB	BB	AA	AA	AA	AA	BB	BB	AB	AB
2	SNP_A-1696327	rs7568703	15041402	15.041402	0.571	AA	AA	AB	AB	AB	AB	BB	BB	AA	AA
2	SNP_A-1683239	rs4668968	15835884	15.835884	0.369	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
2	SNP_A-1677981	rs9306902	16971747	16.971747	0.631	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
2	SNP_A-1714454	rs10495699	19918971	19.918971	0.56	AB	AB	AB	AB	AA	AB	AA	AB	AB	AB
2	SNP_A-1668860	rs10495705	20662972	20.662972	0.564	AA	AA	AA	AA	AA	AA	BB	AB	AA	AA
2	SNP_A-1693698	rs7594267	23344557	23.344557	0.571	AA	AA	BB	BB	BB	BB	BB	BB	AA	AA
2	SNP_A-1751070	rs1275963	26804398	26.804398	0.643	AB	AB	AA	AA	AA	AA	AA	AA	AA	AA
2	SNP_A-1684619	rs2014701	30210694	30.210694	0.631	AA	AA	AA	AA	AA	AA	BB	AB	BB	BB
2	SNP_A-1648557	rs10490360	32207919	32.207919	0.441	BB	BB	AA	AA	AA	AA	BB	BB	AB	AB

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
2	SNP_A-1671421	rs219145	33123165	33.123165	0.634	AA	AA	AA	AA	AA	AA	AA	AA	BB	BB
2	SNP_A-1696185	rs10495796	34029149	34.029149	0.274	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
2	SNP_A-1642658	rs2049638	34866446	34.866446	0.738	AA	AA	AA	AA	AA	AA	AA	AB	AB	AB
2	SNP_A-1696029	rs1401242	35923474	35.923474	0.417	AB	AB	AB	AB	AA	AB	AA	AB	AB	AB
2	SNP_A-1748242	rs2161905	36427824	36.427824	0.286	BB	BB	BB	BB	BB	BB	AA	AB	BB	BB
2	SNP_A-1660238	rs975315	38407251	38.407251	0.631	AB	AB	AA	AA	AA	AA	AA	AB	AA	AA
2	SNP_A-1719460	rs9309043	39939220	39.93922	0.643	BB	BB	AB	AB	BB	AB	BB	BB	BB	BB
2	SNP_A-1714203	rs2059338	41186539	41.186539	0.714	AB	AB	AB	AB	BB	AB	AA	AB	BB	BB
2	SNP_A-1690204	rs10495900	43528810	43.52881	0.369	AB	AB	BB	BB	BB	BB	BB	BB	BB	BB
2	SNP_A-1740164	rs4276071	44121457	44.121457	0.417	BB	BB	AA	AA	AA	AA	AB	AB	BB	BB
2	SNP_A-1685265	rs6708061	44721790	44.72179	0.357	BB	BB	BB	BB	BB	BB	AA	AA	AB	AB
2	SNP_A-1680505	rs6737073	45442330	45.44233	0.286	BB	BB	BB	BB	BB	BB	AA	AA	AB	AB
2	SNP_A-1680749	rs935661	45967008	45.967008	0.56	AB	AB	AB	AA	AB	AB	AB	AB	AB	AB
2	SNP_A-1721531	rs7589621	46494033	46.494033	0.738	AB	AB	AA	AA	AA	AA	AA	AA	AA	AA
2	SNP_A-1734011	rs6544955	47235732	47.235732	0.643	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
2	SNP_A-1699364	rs10495972	49412546	49.412546	0.298	AB	AB	BB	BB	BB	BB	BB	BB	BB	BB
2	SNP_A-1696353	rs10495987	50064931	50.064931	0.286	AB	AB	AA	AA	AA	AA	BB	BB	BB	BB
2	SNP_A-1646009	rs10490176	50979585	50.979585	0.738	AB	AB	AA	AA	AA	AA	AA	AA	AA	AA
2	SNP_A-1676509	rs1160297	53148971	53.148971	0.321	AB	AB	BB	BB	BB	BB	BB	BB	AB	AB
2	SNP_A-1742892	rs843622	54460133	54.460133	0.524	BB	BB	AA	AA	AA	AA	BB	BB	AA	AA
2	SNP_A-1704006	rs5008666	59390639	59.390639	0.65	AA	AA	BB	BB	BB	BB	AA	AA	AA	AB
2	SNP_A-1673301	rs1517401	63452358	63.452358	0.738	AA	AA	BB	BB	BB	BB	AB	AB	AA	AA
2	SNP_A-1711471	rs2581047	64219699	64.219699	0.286	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
2	SNP_A-1652253	rs2971828	66466238	66.466238	0.667	BB	BB	AA	AA	AA	AA	AA	AA	AA	AA
2	SNP_A-1722279	rs9309400	67746695	67.746695	0.738	AB	AB	AA	AA	AA	AA	BB	BB	AA	AA
2	SNP_A-1656216	rs10496165	68531740	68.53174	0.333	BB	BB	BB	BB	BB	BB	BB	BB	AA	AB
2	SNP_A-1703772	rs2312209	69633766	69.633766	0.524	BB	BB	AA	AA	AB	AB	BB	BB	BB	BB
2	SNP_A-1753748	rs10489986	70719802	70.719802	0.75	AA	AA	AA	AA	AA	AA	AB	AB	AA	AA
2	SNP_A-1723065	rs6724782	73591645	73.591645	0.286	AA	AB	BB	BB	BB	BB	AB	AB	BB	BB
2	SNP_A-1665193	rs730148	76269470	76.26947	0.408	BB	BB	AA	AA	AB	AB	AA	AA	BB	BB
2	SNP_A-1718918	rs1446707	77141310	77.14131	0.429	BB	BB	AA	AA	AA	AA	AA	AA	BB	BB
2	SNP_A-1749208	rs4852483	79513076	79.513076	0.75	AA	AB	BB	BB	BB	BB	AA	AA	AA	AA
2	SNP_A-1745171	rs216616	80715814	80.715814	0.298	BB	BB	AA	AA	AA	AA	BB	BB	BB	BB
2	SNP_A-1750234	rs9309572	81381197	81.381197	0.321	BB	BB	BB	BB	BB	AB	AA	AA	BB	AB
2	SNP_A-1728812	rs7577293	85846940	85.84694	0.274	AA	AB	BB	BB	BB	BB	BB	BB	AA	AB
2	SNP_A-1676217	rs9308826	99738211	99.738211	0.738	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
2	SNP_A-1655416	rs9308849	101983905	101.983905	0.714	AA	AA	AA	AA	AA	AA	AA	AB	BB	AB
2	SNP_A-1655538	rs956966	103046093	103.046093	0.512	AA	AA	BB	BB	BB	AB	BB	BB	BB	BB
2	SNP_A-1690274	rs1869070	106074094	106.074094	0.714	AA	AA	AA	AA	AA	AA	AB	AB	AB	AB
2	SNP_A-1742362	rs1398132	106705516	106.705516	0.607	AB	AB	AA	AA	AA	AA	BB	BB	AB	AB
2	SNP_A-1654768	rs826690	108705477	108.705477	0.429	BB	BB	AA	AA	AB	AB	AB	AB	AB	AB
2	SNP_A-1709888	rs1469529	109207139	109.207139	0.583	AB	AB	AA	AA	AB	AB	AB	AB	AA	AA
2	SNP_A-1671489	rs3961919	112959552	112.959552	0.298	BB	BB	AA	AA	AB	AB	AB	AB	AB	AB
2	SNP_A-1720080	rs2166965	114191141	114.191141	0.679	AA	AA	AA	AA	AB	AB	AA	AA	AA	AA
2	SNP_A-1712138	rs1346762	114988791	114.988791	0.72	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
2	SNP_A-1752188	rs9284719	118395025	118.395025	0.595	AB	AB	AA	AA	AA	AA	AA	AA	AA	AA
2	SNP_A-1685413	rs1370380	120731125	120.731125	0.286	AB	AB	AA	AA	AA	AA	BB	BB	AB	AB
2	SNP_A-1721631	rs4848174	122659698	122.659698	0.655	AA	AA	AA	AA	AB	AB	AB	AB	AA	AA
2	SNP_A-1707304	rs1215318	125809045	125.809045	0.536	AA	AA	BB	BB	BB	BB	BB	BB	AB	AB
2	SNP_A-1673583	rs548032	127461866	127.461866	0.631	AA	AA	AA	AA	AA	AA	AA	AA	AB	AB
2	SNP_A-1671177	rs2124432	128900396	128.900396	0.61	AB	AB	AA	AA	AA	AA	AA	AA	AA	AA
2	SNP_A-1676259	rs10496731	135431360	135.43136	0.488	BB	BB	AB	BB	AB	AB	AB	AB	BB	BB
2	SNP_A-1689435	rs10496750	137176540	137.17654	0.667	AB	AB	AB	AA	AB	AB	AA	AA	AB	AB
2	SNP_A-1695208	rs10490739	137712397	137.712397	0.287	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
2	SNP_A-1651715	rs3884566	139082237	139.082237	0.357	AB	AB	BB	BB	BB	BB	AB	AB	AB	AB
2	SNP_A-1665733	rs3922799	139592638	139.592638	0.476	BB	BB	BB	BB	BB	BB	BB	BB	AA	AA
2	SNP_A-1713885	rs838042	140153918	140.153918	0.262	AA	AA	AB	AA	AB	AB	BB	BB	BB	BB
2	SNP_A-1663529	rs1518441	140908218	140.908218	0.286	AA	AA	BB	BB	BB	BB	AB	AB	AB	AB
2	SNP_A-1643152	rs10496859	141502410	141.50241	0.536	BB	BB	AA	AA	AA	AA	AA	AA	BB	BB
2	SNP_A-1689866	rs355562	142245134	142.245134	0.321	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
2	SNP_A-1688373	rs7560400	143121832	143.121832	0.75	AA	AA	AB	BB	AB	AB	AB	AB	AA	AA
2	SNP_A-1725903	rs1437717	146329325	146.329325	0.571	AB	AB	AB	BB	AB	AB	AB	AB	AA	AA
2	SNP_A-1729119	rs1528842	148291308	148.291308	0.75	AB	AB	AB	BB	AB	AB	AA	AA	AA	AA
2	SNP_A-1716616	rs6734792	151450390	151.45039	0.738	AA	AA	AA	AA	AA	AA	BB	BB	AA	AA
2	SNP_A-1645341	rs9287956	151979514	151.979514	0.464	BB	BB	AA	AA	AA	AA	AB	AB	AB	AB
2	SNP_A-1711079	rs1370502	153235438	153.235438	0.667	BB	BB	BB	BB	BB	BB	AA	AA	AB	AB
2	SNP_A-1751360	rs10497129	153977886	153.977886	0.31	AB	AB	AA	AA	AA	AA	BB	BB	BB	BB
2	SNP_A-1682179	rs1469155	155088509	155.088509	0.726	AA	AA	AA	AA	AA	AA	BB	BB	AB	AB
2	SNP_A-1729675	rs6750583	159423695	159.423695	0.738	BB	BB	AB	BB	AA	AB	AB	AB	AB	AB
2	SNP_A-1710753	rs997163	161593412	161.593412	0.366	AA	AA	BB	BB	BB	BB	AA	AA	BB	BB
2	SNP_A-1657420	rs1227921	162517707	162.517707	0.512	BB	BB	AB	BB	AA	AB	AB	AB	BB	BB
2	SNP_A-1681353	rs1446471	164812395	164.812395	0.345	BB	BB	AB	AA	BB	AB	AA	AA	BB	BB

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
2	SNP_A-1755647	rs10497261	166152395	166.152395	0.702	AB	AB	AA	AA	AA	AA	AB	AB	BB	AB
2	SNP_A-1656096	rs9287874	167411538	167.411538	0.738	AA	AA	AA	AA	AA	AA	AB	AB	BB	AB
2	SNP_A-1673653	rs2278785	168822282	168.822282	0.381	BB	BB	BB	BB	BB	BB	AA	AA	BB	BB
2	SNP_A-1702574	rs830995	169955143	169.955143	0.702	AA	AA	AA	AA	AA	AA	AB	AB	AA	AB
2	SNP_A-1645337	rs961313	170759024	170.759024	0.274	BB	BB	BB	BB	BB	BB	AB	AB	BB	BB
2	SNP_A-1687817	rs731693	171622741	171.622741	0.667	AA	AA	AA	AA	AA	AA	AB	AB	BB	BB
2	SNP_A-1749036	rs4095835	172330518	172.330518	0.429	BB	BB	BB	BB	BB	BB	BB	BB	BB	AB
2	SNP_A-1683223	rs7575189	173840675	173.840675	0.512	BB	BB	AB	BB	AA	AB	AB	AB	BB	BB
2	SNP_A-1743510	rs2119137	174843221	174.843221	0.333	AB	AB	AB	AA	BB	AB	AB	AB	BB	BB
2	SNP_A-1673703	rs1993385	175563974	175.563974	0.476	AA	AA	AB	BB	AA	AB	AB	AB	AA	AB
2	SNP_A-1730586	rs9287989	176543248	176.543248	0.643	BB	BB	AA	AA	AA	AA	AA	AA	AA	AB
2	SNP_A-1676261	rs6722762	177140660	177.14066	0.345	AB	AB	BB	BB	BB	BB	AB	AB	AA	AB
2	SNP_A-1668972	rs10497467	177733918	177.733918	0.75	AA	AA	AB	BB	AA	AB	AB	AB	AA	AA
2	SNP_A-1643400	rs2008999	179796838	179.796838	0.643	AA	AA	BB	BB	BB	BB	AA	AA	AA	AA
2	SNP_A-1721647	rs259845	180560120	180.56012	0.75	AA	AA	AA	AA	AA	AA	BB	BB	BB	BB
2	SNP_A-1643999	rs9288052	181299542	181.299542	0.488	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
2	SNP_A-1668465	rs288332	183450856	183.450856	0.262	BB	BB	AA	AA	AA	AA	AA	AA	AA	AB
2	SNP_A-1723211	rs1454042	184407382	184.407382	0.357	BB	BB	BB	BB	BB	BB	AB	AB	AA	AB
2	SNP_A-1668055	rs10490389	186428458	186.428458	0.702	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
2	SNP_A-1678177	rs2044683	187026818	187.026818	0.366	BB	BB	BB	BB	BB	BB	AB	AB	BB	BB
2	SNP_A-1728072	rs840611	188023952	188.023952	0.583	BB	BB	BB	BB	BB	BB	BB	BB	AA	AA
2	SNP_A-1750900	rs10497725	192818722	192.818722	0.667	AA	AA	BB	BB	BB	BB	AA	AA	AA	AB
2	SNP_A-1642958	rs10497744	194316402	194.316402	0.31	BB	BB	BB	BB	BB	BB	BB	BB	BB	AB
2	SNP_A-1669242	rs1350208	198911771	198.911771	0.571	AB	AB	AB	BB	AB	AB	AA	AA	AA	AB
2	SNP_A-1673517	rs10497821	199463403	199.463403	0.31	BB	BB	BB	BB	BB	BB	BB	BB	AA	AB
2	SNP_A-1645863	rs1376877	204097596	204.097596	0.607	AA	AA	BB	BB	BB	BB	BB	BB	BB	AB
2	SNP_A-1650883	rs6707500	204941128	204.941128	0.667	AB	AB	AA	AA	AA	AA	AA	AA	AA	AA
2	SNP_A-1757786	rs10490293	206049378	206.049378	0.274	BB	BB	AA	AA	AA	AA	BB	BB	BB	BB
2	SNP_A-1752790	rs10490474	207934338	207.934338	0.571	BB	BB	AB	AA	AB	AB	AB	AB	AA	AA
2	SNP_A-1642246	rs10497888	208586741	208.586741	0.679	AA	AA	BB	BB	BB	BB	AA	AA	AA	AA
2	SNP_A-1644145	rs1607181	209364109	209.364109	0.655	AA	AB	AA	AA	AA	AA	AB	AB	BB	AB
2	SNP_A-1669816	rs1816532	212093746	212.093746	0.75	AA	AA	BB	BB	BB	BB	AA	AA	AA	AA
2	SNP_A-1661335	rs1402769	212906949	212.906949	0.274	BB	BB	BB	BB	BB	BB	BB	BB	BB	AB
2	SNP_A-1720206	rs10497986	213664725	213.664725	0.702	AA	AA	BB	BB	BB	BB	AB	AB	AA	AA
2	SNP_A-1701518	rs9283527	214674151	214.674151	0.417	AA	AA	AB	BB	AB	AB	AA	AA	AA	AA
2	SNP_A-1692929	rs2166459	215505298	215.505298	0.31	AA	AB	BB	BB	BB	BB	AA	AA	BB	AB

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
2	SNP_A-1755667	rs1250225	216151895	216.151895	0.744	BB	AB	AA	AA	AA	AA	AA	AA	AA	AA
2	SNP_A-1705890	rs1110998	217169458	217.169458	0.429	BB	BB	AB	AA	AB	AB	BB	BB	BB	BB
2	SNP_A-1743410	rs6719545	218277340	218.27734	0.286	BB	AB	BB	BB	BB	BB	BB	BB	AA	AB
2	SNP_A-1728154	rs1344645	219363524	219.363524	0.405	AA	AB	BB	BB	BB	BB	AA	AA	BB	BB
2	SNP_A-1726837	rs715345	220649461	220.649461	0.274	AA	AA	AB	AB	AB	AB	BB	BB	BB	BB
2	SNP_A-1721280	rs1356399	221348562	221.348562	0.702	AA	AA	AB	AB	AB	AB	BB	AB	AA	AA
2	SNP_A-1655920	rs1430234	222049201	222.049201	0.274	BB	BB	BB	BB	BB	BB	BB	BB	BB	AB
2	SNP_A-1711521	rs4673013	222802583	222.802583	0.619	BB	AB	AB	AB	AB	AB	AA	AA	AA	AB
2	SNP_A-1695224	rs1961637	223730613	223.730613	0.452	AA	AB	AB	AB	AB	AB	BB	BB	BB	BB
2	SNP_A-1713318	rs10498158	224777152	224.777152	0.417	AA	AB	BB	BB	BB	BB	BB	BB	BB	BB
2	SNP_A-1702406	rs10498171	225622115	225.622115	0.524	BB	AB	AA	AA	AA	AA	BB	AB	BB	AB
2	SNP_A-1643000	rs1835533	226193946	226.193946	0.738	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
2	SNP_A-1739924	rs1522804	226814661	226.814661	0.548	AA	AB	AB	AB	AB	AB	BB	BB	BB	AB
2	SNP_A-1683533	rs1950134	227888457	227.888457	0.714	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
2	SNP_A-1663421	rs1524023	228615089	228.615089	0.75	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
2	SNP_A-1707748	rs6759815	229797926	229.797926	0.571	BB	BB	AA	AA	AA	AA	BB	BB	BB	AB
2	SNP_A-1661533	rs4973304	230936568	230.936568	0.298	BB	BB	BB	BB	BB	BB	AA	AA	AA	AB
2	SNP_A-1727506	rs10498257	231818543	231.818543	0.702	BB	AB	AB	AB	AB	AB	BB	AB	AA	AA
2	SNP_A-1728658	rs3791711	233258388	233.258388	0.524	BB	AB	BB	BB	BB	BB	BB	AB	AA	AB
2	SNP_A-1747120	rs1880747	235240125	235.240125	0.512	BB	AB	AA	AA	AA	AA	BB	AB	AA	AA
2	SNP_A-1738177	rs103718	239180488	239.180488	0.441	AA	AA	AA	AA	AA	AA	AB	AB	AA	AA
3	SNP_A-1675236	rs1516342	147906	0.147906	0.262	AB	AB	BB	BB	BB	BB	AA	AB	BB	BB
3	SNP_A-1754907	rs10510204	981912	0.981912	0.405	AA	AA	AA	AA	AA	AA	AA	AB	AA	AA
3	SNP_A-1726483	rs1720194	2366613	2.366613	0.631	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
3	SNP_A-1717220	rs1508734	3538991	3.538991	0.607	AB	AB	AB	BB	BB	AB	BB	AB	AB	AB
3	SNP_A-1668475	rs4684484	5437541	5.437541	0.441	BB	BB	AA	AA	AA	AA	AA	AA	AA	AA
3	SNP_A-1646075	rs9311817	6172932	6.172932	0.72	AB	AB	AA	AA	AA	AA	AA	AA	AB	AB
3	SNP_A-1658187	rs1450097	7520521	7.520521	0.293	BB	BB	BB	BB	BB	BB	AB	AB	AB	AB
3	SNP_A-1718736	rs486012	9016299	9.016299	0.56	AA	AA	AA	AA	AA	AA	AB	AB	AA	AB
3	SNP_A-1679373	rs2160871	10421826	10.421826	0.75	AB	AB	AB	BB	BB	AB	AA	AA	AA	AB
3	SNP_A-1649097	rs6792718	11409380	11.40938	0.429	AB	AB	AA	AA	AA	AA	AA	AA	AA	AA
3	SNP_A-1713577	rs172429	14880517	14.880517	0.25	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
3	SNP_A-1719120	rs1983085	15504547	15.504547	0.56	AA	AA	BB	BB	BB	BB	AB	AB	AA	AA
3	SNP_A-1701284	rs2733528	17211259	17.211259	0.571	AB	AB	AA	AA	AA	AA	AB	AB	BB	BB
3	SNP_A-1653347	rs336615	18605807	18.605807	0.619	AA	AA	AB	BB	BB	AB	AB	AB	BB	AB
3	SNP_A-1753110	rs2053506	19350795	19.350795	0.595	AA	AA	AA	AA	AA	AA	AA	AA	BB	BB

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
3	SNP_A-1649119	rs6770717	20406548	20.406548	0.726	AB	AB	AA	AA	AA	AA	AA	AA	AA	AA
3	SNP_A-1685927	rs365392	21465872	21.465872	0.583	BB	BB	AB	BB	BB	AB	AB	AB	BB	AB
3	SNP_A-1738848	rs3732395	23209622	23.209622	0.378	AA	AB	BB	BB	BB	BB	BB	BB	BB	AB
3	SNP_A-1730534	rs10510568	25577736	25.577736	0.679	BB	AB	AA	AA	AA	AA	AB	AB	AA	AB
3	SNP_A-1725077	rs9284859	26883268	26.883268	0.655	BB	BB	AB	AB	BB	AB	AB	AB	BB	AB
3	SNP_A-1647333	rs7639905	27951868	27.951868	0.429	BB	AB	BB	BB	BB	BB	BB	BB	AA	AA
3	SNP_A-1744932	rs9310901	29477393	29.477393	0.274	BB	AB	AA	AA	AA	AA	AB	AB	BB	AB
3	SNP_A-1741570	rs795347	30720945	30.720945	0.369	AA	AB	AB	AB	AB	AB	BB	BB	BB	BB
3	SNP_A-1747050	rs347163	32435579	32.435579	0.393	BB	BB	BB	BB	BB	BB	BB	BB	AB	AB
3	SNP_A-1735191	rs1376015	35274750	35.27475	0.595	BB	AB	AB	AB	AB	AB	AB	AB	BB	BB
3	SNP_A-1717686	rs10510667	35834447	35.834447	0.476	BB	BB	AA	AA	AA	AA	BB	BB	AB	AB
3	SNP_A-1643995	rs10510695	37621200	37.6212	0.738	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
3	SNP_A-1649705	rs2220345	41411812	41.411812	0.429	AA	AB	AA	AA	AA	AA	AB	AB	AB	AB
3	SNP_A-1699750	rs531888	43047989	43.047989	0.476	BB	AB	AB	AB	AB	AB	AB	AB	AA	AA
3	SNP_A-1722715	rs2742393	45732421	45.732421	0.417	AA	AA	AB	AB	AB	AB	BB	BB	AA	AA
3	SNP_A-1694360	rs7620394	55206368	55.206368	0.345	BB	BB	AA	AA	AA	AA	BB	BB	AB	AB
3	SNP_A-1643909	rs6445844	57028961	57.028961	0.726	BB	BB	AB	AB	AB	AB	AB	AB	AA	AA
3	SNP_A-1652229	rs10510803	59329572	59.329572	0.488	BB	BB	AB	AB	AB	AB	AB	AB	AB	AB
3	SNP_A-1669748	rs3843360	60016727	60.016727	0.393	BB	BB	AB	AB	AB	AB	AB	AB	AA	AA
3	SNP_A-1678019	rs1996520	61592725	61.592725	0.488	BB	BB	BB	BB	BB	BB	AB	AB	AB	AB
3	SNP_A-1665709	rs7650561	62466087	62.466087	0.643	AA	AA	AB	AB	AB	AB	AA	AA	AB	AB
3	SNP_A-1684953	rs10510929	64709076	64.709076	0.583	BB	BB	BB	BB	BB	BB	AA	AA	BB	AB
3	SNP_A-1688393	rs725160	66943022	66.943022	0.464	AA	AA	BB	BB	BB	BB	AB	AB	BB	BB
3	SNP_A-1678015	rs4145917	68099517	68.099517	0.679	AB	AB	AA	AA	AA	AA	AA	AA	AA	AA
3	SNP_A-1707438	rs2872939	69802192	69.802192	0.405	AB	AB	AA	AA	AA	AA	AB	AB	BB	BB
3	SNP_A-1663707	rs10510996	70545357	70.545357	0.75	AA	AA	AA	AB	AB	AB	AA	AA	AA	AB
3	SNP_A-1650625	rs830644	71748249	71.748249	0.5	AB	AB	BB	BB	BB	BB	BB	BB	AA	AB
3	SNP_A-1713028	rs4677226	73154304	73.154304	0.613	BB	BB	BB	BB	BB	BB	AB	AB	AA	AA
3	SNP_A-1685633	rs1107768	73959415	73.959415	0.726	AB	AB	AA	AA	AA	AA	BB	AB	AA	AA
3	SNP_A-1722733	rs10511039	76184447	76.184447	0.583	AA	AA	BB	BB	BB	BB	AA	AA	BB	BB
3	SNP_A-1648479	rs251552	76852596	76.852596	0.539	AB	AB	AA	AA	AA	AA	AA	AB	BB	AB
3	SNP_A-1642486	rs9309840	80029943	80.029943	0.588	BB	BB	BB	BB	BB	BB	BB	AB	BB	BB
3	SNP_A-1685115	rs2639611	81623522	81.623522	0.274	BB	BB	BB	BB	BB	BB	BB	BB	AA	AA
3	SNP_A-1642250	rs9309888	82418655	82.418655	0.262	BB	AB	BB	BB	BB	BB	BB	BB	AA	AB
3	SNP_A-1732971	rs10511085	85614577	85.614577	0.619	BB	AB	BB	AB	BB	AB	AA	AA	AA	AB
3	SNP_A-1731608	rs1509783	87634505	87.634505	0.476	BB	BB	BB	BB	BB	BB	AA	AB	BB	BB

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
3	SNP_A-1721601	rs9310061	88146455	88.146455	0.631	AA	AA	BB	BB	BB	AB	AA	AA	AA	AB
3	SNP_A-1715294	rs724972	89664098	89.664098	0.607	AA	AB	AA	AA	AA	AA	AA	AA	AA	AA
3	SNP_A-1648583	rs10511152	96638708	96.638708	0.381	BB	BB	AA	AA	AA	AB	AA	AB	BB	AB
3	SNP_A-1701406	rs3856571	99031739	99.031739	0.298	BB	AB	BB	BB	BB	BB	BB	BB	BB	BB
3	SNP_A-1643841	rs10511169	100116062	100.116062	0.691	AA	AA	AA	AA	AA	AA	AA	AB	BB	AB
3	SNP_A-1697988	rs2700633	100643241	100.643241	0.643	AA	AB	AA	AA	AA	AA	AA	AA	BB	AB
3	SNP_A-1740468	rs10511183	102046105	102.046105	0.738	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
3	SNP_A-1746982	rs974059	103277828	103.277828	0.25	BB	BB	BB	BB	BB	BB	AA	AB	BB	AB
3	SNP_A-1687227	rs1391423	103923668	103.923668	0.732	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
3	SNP_A-1677819	rs10511221	105099054	105.099054	0.726	BB	AB	AA	AA	AB	AB	AA	AA	AA	AB
3	SNP_A-1663937	rs6783422	106031580	106.03158	0.393	AA	AA	AA	AA	AA	AA	BB	BB	AA	AA
3	SNP_A-1674588	rs10511243	106653352	106.653352	0.667	AA	AA	AA	AA	AA	AA	BB	AB	AA	AB
3	SNP_A-1652015	rs2222039	108202685	108.202685	0.691	BB	AB	AA	AA	AA	AA	AA	AA	AA	AA
3	SNP_A-1722407	rs1525873	111232702	111.232702	0.702	BB	AB	BB	BB	BB	BB	AA	AA	AA	AB
3	SNP_A-1674512	rs1512514	111766406	111.766406	0.488	BB	AB	AA	AA	AA	AA	AA	AA	AA	AA
3	SNP_A-1747616	rs1797626	114308943	114.308943	0.702	AA	AA	BB	BB	AB	AB	AA	AA	AA	AA
3	SNP_A-1668954	rs1553209	116705663	116.705663	0.476	BB	AB	AA	AA	AA	AA	BB	BB	BB	BB
3	SNP_A-1674292	rs7621196	117804184	117.804184	0.321	BB	BB	AA	AA	AA	AA	BB	AB	AA	AB
3	SNP_A-1643903	rs1218621	118459636	118.459636	0.31	AA	AA	BB	BB	BB	BB	BB	BB	BB	BB
3	SNP_A-1728638	rs950649	121567065	121.567065	0.691	BB	AB	AA	AA	AA	AA	AA	AA	AA	AA
3	SNP_A-1730195	rs2126140	122627958	122.627958	0.5	BB	AB	AB	AA	AB	AB	AB	AB	AA	AA
3	SNP_A-1741126	rs10511409	123610479	123.610479	0.738	BB	AB	AA	AA	AA	AA	AB	AB	BB	AB
3	SNP_A-1739520	rs1373606	125496637	125.496637	0.342	AA	AA	BB	BB	BB	BB	AA	AA	AA	AA
3	SNP_A-1727336	rs1374804	127391196	127.391196	0.524	AA	AB	AB	AA	AB	AB	BB	BB	AA	AA
3	SNP_A-1683659	rs2718880	132343455	132.343455	0.75	AA	AA	AA	AA	AA	AA	AB	AB	AA	AA
3	SNP_A-1747192	rs1553975	132999274	132.999274	0.369	BB	BB	AB	AA	AB	AB	AB	AB	BB	BB
3	SNP_A-1744702	rs2310229	133541978	133.541978	0.691	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
3	SNP_A-1730051	rs711923	136539253	136.539253	0.744	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
3	SNP_A-1654278	rs838623	144671624	144.671624	0.619	AA	AA	AA	AA	AA	AA	AA	AA	BB	AB
3	SNP_A-1730514	rs4610179	146387799	146.387799	0.726	AB	AB	AA	AA	AA	AA	AA	AA	AA	AA
3	SNP_A-1700733	rs4592991	147111601	147.111601	0.393	BB	BB	BB	BB	BB	BB	AA	AA	AB	AB
3	SNP_A-1744174	rs7645488	149410366	149.410366	0.31	AB	AB	BB	BB	BB	BB	BB	BB	AB	AB
3	SNP_A-1718574	rs2130319	150976344	150.976344	0.333	AB	AB	BB	BB	BB	BB	AA	AA	AB	AB
3	SNP_A-1718772	rs7648424	151906089	151.906089	0.488	AB	AB	BB	BB	BB	BB	AA	AB	AB	AB
3	SNP_A-1663723	rs10513399	152600180	152.60018	0.488	BB	BB	BB	BB	BB	BB	BB	BB	AB	AB
3	SNP_A-1746211	rs2418925	155234610	155.23461	0.524	AA	AA	AB	AB	AA	AB	BB	BB	BB	BB

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
3	SNP_A-1658251	rs6772323	157710345	157.710345	0.667	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
3	SNP_A-1736960	rs4679851	160261035	160.261035	0.274	AB	AB	BB	BB	BB	BB	BB	AB	AB	AB
3	SNP_A-1716368	rs10513549	161237209	161.237209	0.25	BB	BB	AB	AB	AA	AB	BB	AB	AB	AB
3	SNP_A-1726685	rs336583	162564683	162.564683	0.417	AA	AA	BB	BB	BB	BB	BB	BB	BB	BB
3	SNP_A-1721879	rs7635791	163720371	163.720371	0.655	AA	AA	AB	AB	AA	AB	BB	AB	AB	AB
3	SNP_A-1745785	rs9290201	164397051	164.397051	0.31	AB	AB	AB	AB	AA	AB	BB	AB	AB	AB
3	SNP_A-1697475	rs4352381	165179142	165.179142	0.369	BB	BB	AA	AA	AA	AA	AA	AB	AB	AB
3	SNP_A-1748578	rs2643191	165861395	165.861395	0.524	AA	AA	AA	AA	AA	AA	BB	BB	BB	BB
3	SNP_A-1687865	rs1371900	167443656	167.443656	0.286	AB	AB	AB	AB	AA	AB	BB	BB	AB	AB
3	SNP_A-1680949	rs1877269	170109722	170.109722	0.548	AB	AB	AB	AB	AA	AB	AB	AB	AB	AB
3	SNP_A-1731022	rs8192675	172207585	172.207585	0.732	AB	AB	AB	AB	BB	AB	AA	AA	AA	AA
3	SNP_A-1656780	rs7627220	173288405	173.288405	0.441	AB	AB	AA	AA	AA	AA	BB	BB	AB	AB
3	SNP_A-1720350	rs792354	174456847	174.456847	0.357	BB	BB	AA	AA	AA	AA	BB	BB	BB	BB
3	SNP_A-1662989	rs1377828	177727744	177.727744	0.286	AA	AA	BB	BB	BB	BB	BB	BB	BB	BB
3	SNP_A-1651103	rs2160836	179192927	179.192927	0.662	AB	AB	BB	BB	BB	BB	AA	AA	AA	AA
3	SNP_A-1699226	rs6762743	180494702	180.494702	0.667	AA	AA	AA	AA	AA	AA	AA	AA	AB	AB
3	SNP_A-1655724	rs262958	184975690	184.97569	0.583	AB	AB	AA	AA	AA	AA	BB	BB	AB	AB
3	SNP_A-1726281	rs10513799	186032241	186.032241	0.75	AB	AB	AA	AA	AA	AA	AB	AB	AB	AB
3	SNP_A-1649485	rs1962838	189742951	189.742951	0.405	AB	AB	AB	AB	AB	AB	AA	AA	AB	AB
3	SNP_A-1756920	rs2378464	190305279	190.305279	0.262	AB	AB	BB	BB	BB	BB	AB	AB	BB	BB
3	SNP_A-1734403	rs3773928	191066407	191.066407	0.405	BB	BB	AB	AB	AB	AB	BB	BB	AB	AB
3	SNP_A-1720858	rs1405036	192749559	192.749559	0.262	AB	AB	AB	AB	AB	AB	BB	BB	BB	BB
3	SNP_A-1706600	rs1403033	193538911	193.538911	0.441	AB	AB	AA	AA	AA	AA	AB	AB	AB	AB
3	SNP_A-1643612	rs587612	195020261	195.020261	0.369	AA	AA	BB	BB	BB	BB	AA	AA	BB	BB
4	SNP_A-1669560	rs1059159	5647306	5.647306	0.683	AB	AB	AA	AA	AA	AA	AA	AA	BB	BB
4	SNP_A-1743690	rs10489076	9947117	9.947117	0.691	AB	AB	AA	AA	AA	AA	AB	AB	AA	AB
4	SNP_A-1736300	rs959233	10578428	10.578428	0.452	AA	AA	AA	AA	AA	AA	AB	AB	BB	BB
4	SNP_A-1750658	rs10516254	12310930	12.31093	0.714	AA	AA	AB	AB	AB	AB	BB	BB	BB	AB
4	SNP_A-1712820	rs10489092	13327021	13.327021	0.286	AB	AB	AA	AA	AA	AA	AB	AB	AA	AB
4	SNP_A-1709160	rs10488982	14088975	14.088975	0.5	AB	AB	AB	AA	AB	AB	BB	BB	BB	BB
4	SNP_A-1748456	rs1496747	16275503	16.275503	0.476	BB	BB	AB	BB	AB	AB	AB	AB	BB	BB
4	SNP_A-1674656	rs10516339	19549340	19.54934	0.725	AA	AB	AA	AA	AA	AA	AA	AA	AA	AA
4	SNP_A-1659171	rs6834573	20123113	20.123113	0.298	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
4	SNP_A-1687559	rs10516397	21369936	21.369936	0.405	BB	BB	AB	BB	AB	AB	BB	BB	AA	AA
4	SNP_A-1695570	rs2036713	22984189	22.984189	0.357	BB	AB	AB	BB	AB	AB	BB	BB	BB	AB
4	SNP_A-1649429	rs1527354	24561836	24.561836	0.655	BB	AB	BB	BB	BB	BB	AA	AA	BB	BB

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
4	SNP_A-1710973	rs7697266	25453418	25.453418	0.393	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
4	SNP_A-1748352	rs9291495	27032051	27.032051	0.75	AA	AA	AA	AA	AA	AA	AA	AA	AA	AB
4	SNP_A-1737486	rs1397438	28093488	28.093488	0.463	BB	BB	BB	BB	BB	BB	BB	BB	AA	AA
4	SNP_A-1660740	rs939573	28670407	28.670407	0.75	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
4	SNP_A-1659069	rs1441691	29221732	29.221732	0.274	BB	BB	AB	BB	AB	AB	BB	BB	BB	AB
4	SNP_A-1731582	rs2571468	29891942	29.891942	0.667	AA	AA	AB	AA	AB	AB	AB	AB	AA	AA
4	SNP_A-1666099	rs412253	31119019	31.119019	0.72	AA	AA	AB	BB	AB	AB	AB	AB	AA	AA
4	SNP_A-1659419	rs10517232	31725815	31.725815	0.321	BB	BB	AA	AA	AA	AA	BB	BB	AA	AA
4	SNP_A-1743944	rs2588544	36822899	36.822899	0.281	AA	AB	BB	BB	BB	BB	BB	BB	BB	BB
4	SNP_A-1650541	rs7693744	42094241	42.094241	0.488	AA	AA	AB	AA	AA	AB	AA	AB	AA	AA
4	SNP_A-1651577	rs10517054	42743857	42.743857	0.726	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
4	SNP_A-1708293	rs10517094	44153139	44.153139	0.31	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
4	SNP_A-1672145	rs10517121	44712712	44.712712	0.583	AA	AA	AB	AA	AA	AB	AA	AB	BB	AB
4	SNP_A-1742914	rs1552419	45366813	45.366813	0.583	AA	AB	AA	AA	AA	AA	BB	AB	AA	AA
4	SNP_A-1741538	rs279842	46181884	46.181884	0.439	BB	BB	BB	BB	BB	BB	BB	AB	AA	AB
4	SNP_A-1726797	rs3934674	46854066	46.854066	0.305	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
4	SNP_A-1734487	rs6447614	47908885	47.908885	0.549	AA	AB	AA	AA	AA	AB	AA	AA	BB	AB
4	SNP_A-1659623	rs6850277	54268853	54.268853	0.667	AB	AB	AA	AA	AA	AA	AA	AB	AA	AA
4	SNP_A-1724073	rs2726610	55528245	55.528245	0.548	BB	BB	BB	BB	BB	BB	BB	AB	AA	AB
4	SNP_A-1643184	rs4580704	56167635	56.167635	0.643	AB	AB	AA	AA	AA	AA	AA	AA	AA	AB
4	SNP_A-1647321	rs10517400	58338522	58.338522	0.679	AB	AB	BB	BB	AB	AB	AB	AB	BB	BB
4	SNP_A-1685901	rs10517453	60065841	60.065841	0.679	AA	AA	BB	BB	BB	BB	AB	AB	BB	BB
4	SNP_A-1660836	rs2129274	61712878	61.712878	0.613	BB	BB	BB	BB	BB	BB	BB	BB	AA	AA
4	SNP_A-1712860	rs2345043	62476674	62.476674	0.619	AA	AA	AA	AA	AA	AA	BB	BB	BB	BB
4	SNP_A-1706808	rs2199219	63012534	63.012534	0.321	AB	AB	AA	AA	AA	AA	BB	BB	AA	AB
4	SNP_A-1657186	rs7674285	65578799	65.578799	0.536	BB	BB	BB	BB	BB	BB	AA	AA	AA	AA
4	SNP_A-1701798	rs1450036	67486005	67.486005	0.619	AA	AA	AA	AA	AB	AB	AA	AA	AA	AB
4	SNP_A-1734479	rs2736466	70507268	70.507268	0.679	AB	AB	AA	AA	AA	AA	AA	AA	AB	AB
4	SNP_A-1645045	rs3775745	71293834	71.293834	0.536	BB	BB	AA	AA	AA	AA	AA	AA	AB	AB
4	SNP_A-1741102	rs7678694	75663264	75.663264	0.476	BB	BB	AA	AA	AA	AA	BB	BB	AA	AA
4	SNP_A-1670999	rs925454	77604654	77.604654	0.595	AA	AA	AA	AA	AB	AB	AA	AA	AB	AB
4	SNP_A-1738063	rs2703134	78171011	78.171011	0.691	AB	AB	AA	AA	AA	AA	AA	AB	AA	AA
4	SNP_A-1654306	rs10518188	79483184	79.483184	0.405	AB	AB	BB	BB	BB	BB	BB	AB	BB	BB
4	SNP_A-1661108	rs2119421	80807501	80.807501	0.714	AA	AA	AA	AA	AA	AA	AA	AA	BB	BB
4	SNP_A-1703940	rs9307787	83047673	83.047673	0.75	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
4	SNP_A-1650367	rs6813014	84235884	84.235884	0.548	AB	AB	AA	AA	BB	AB	BB	BB	AA	AA

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
4	SNP_A-1752998	rs10516708	85194717	85.194717	0.643	AA	AA	AA	AA	AA	AA	AA	AA	AB	AB
4	SNP_A-1669642	rs10516739	86522131	86.522131	0.655	AB	AB	BB	BB	AA	AB	AA	AA	AB	AB
4	SNP_A-1725569	rs10516760	87083328	87.083328	0.25	BB	BB	BB	BB	BB	BB	AA	AA	AA	AA
4	SNP_A-1732366	rs4693803	88425710	88.42571	0.5	AA	AA	AA	AA	BB	AB	AA	AA	AB	AB
4	SNP_A-1657663	rs10516796	89213912	89.213912	0.634	AA	AA	AA	AA	AA	AA	BB	AB	BB	BB
4	SNP_A-1718322	rs1903002	90098072	90.098072	0.464	BB	BB	AA	AA	BB	AB	AA	AA	AB	AB
4	SNP_A-1659867	rs7693500	90643667	90.643667	0.691	AA	AA	AA	AA	AA	AA	AA	AB	BB	BB
4	SNP_A-1705800	rs4694023	91613152	91.613152	0.393	AB	AB	BB	BB	BB	BB	AA	AA	AB	AB
4	SNP_A-1757446	rs7696847	92155216	92.155216	0.714	AA	AA	BB	BB	AA	AB	AA	AB	AB	AB
4	SNP_A-1749382	rs6827937	94157783	94.157783	0.452	BB	BB	BB	BB	BB	BB	AA	AB	AB	AB
4	SNP_A-1727842	rs10516919	94713877	94.713877	0.667	AB	AB	AA	AA	AA	AA	AA	AA	AA	AA
4	SNP_A-1745861	rs1048627	95944765	95.944765	0.595	AA	AA	AA	AA	BB	AB	AA	AA	AA	AA
4	SNP_A-1683945	rs1384869	96613355	96.613355	0.274	BB	BB	AA	AA	AA	AA	BB	AB	BB	BB
4	SNP_A-1756011	rs6853079	99800789	99.800789	0.286	BB	BB	BB	BB	BB	BB	BB	BB	AA	AA
4	SNP_A-1703546	rs1230164	100343201	100.343201	0.274	AB	AB	BB	BB	AA	AB	BB	AB	BB	BB
4	SNP_A-1740940	rs238486	103377982	103.377982	0.595	AA	AA	AA	AA	BB	AB	AA	AA	BB	BB
4	SNP_A-1684917	rs227284	103964838	103.964838	0.655	AA	AA	AA	AA	BB	AB	BB	BB	AB	AB
4	SNP_A-1753948	rs445761	104804695	104.804695	0.679	AB	AB	AA	AA	AA	AA	AA	AA	AA	AA
4	SNP_A-1747884	rs2866685	105649408	105.649408	0.5	BB	BB	AA	AA	BB	AB	AB	AB	AB	AB
4	SNP_A-1720092	rs1873361	106282703	106.282703	0.345	BB	BB	AA	AA	AA	AA	BB	BB	BB	BB
4	SNP_A-1721929	rs715706	106873632	106.873632	0.286	BB	BB	BB	BB	BB	BB	BB	BB	AA	AA
4	SNP_A-1662125	rs1468221	108745388	108.745388	0.31	AA	AA	BB	BB	BB	BB	AB	AB	BB	BB
4	SNP_A-1642856	rs7654940	110143969	110.143969	0.524	AB	AB	BB	BB	AA	AB	AB	AB	AB	AB
4	SNP_A-1686749	rs6841595	113711446	113.711446	0.317	BB	BB	BB	BB	BB	BB	BB	BB	AB	AB
4	SNP_A-1736814	rs10516593	114436416	114.436416	0.524	BB	BB	BB	BB	AB	AB	AA	AA	AA	AA
4	SNP_A-1732667	rs998359	116228635	116.228635	0.441	BB	BB	BB	BB	BB	BB	BB	BB	AB	AB
4	SNP_A-1671469	rs292910	117406405	117.406405	0.607	AA	AA	AA	AA	AA	AA	AA	AA	AB	AB
4	SNP_A-1696003	rs2125710	118964366	118.964366	0.25	BB	BB	BB	BB	BB	BB	BB	BB	AB	AB
4	SNP_A-1695754	rs10518293	119688966	119.688966	0.691	AA	AA	BB	BB	BB	BB	AA	AA	AB	AB
4	SNP_A-1745189	rs10518336	120880537	120.880537	0.536	AA	AA	BB	BB	AB	AB	BB	BB	AB	AB
4	SNP_A-1648947	rs2036696	121573324	121.573324	0.667	AA	AA	BB	BB	BB	BB	BB	BB	AB	AB
4	SNP_A-1702984	rs998327	122441717	122.441717	0.726	AA	AA	AA	AA	AB	AB	AA	AA	AA	AA
4	SNP_A-1733111	rs4833836	123858274	123.858274	0.381	BB	BB	BB	BB	BB	BB	AB	AB	BB	BB
4	SNP_A-1643743	rs444646	124370464	124.370464	0.548	AB	AB	AA	AA	AB	AB	BB	BB	AA	AA
4	SNP_A-1746251	rs10518307	125084153	125.084153	0.262	AB	AB	BB	BB	BB	BB	BB	BB	BB	BB
4	SNP_A-1648121	rs7682791	125875709	125.875709	0.631	AA	AA	AA	AA	AA	AA	AA	AA	BB	BB

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
4	SNP_A-1699868	rs953211	126708654	126.708654	0.488	AB	AB	AA	AA	AA	AA	AB	AB	AA	AA
4	SNP_A-1706772	rs4834083	127331109	127.331109	0.726	AA	AA	BB	BB	AB	AB	AA	AA	AB	AB
4	SNP_A-1653649	rs318510	130173248	130.173248	0.571	AA	AA	BB	BB	BB	BB	AA	AA	AA	AA
4	SNP_A-1655974	rs2969001	131140397	131.140397	0.643	AA	AA	AA	AA	AA	AA	AB	AB	AA	AA
4	SNP_A-1694056	rs6846560	131988611	131.988611	0.357	BB	BB	BB	BB	BB	BB	AB	AB	BB	AB
4	SNP_A-1719820	rs10518609	133609659	133.609659	0.658	AA	AA	BB	BB	BB	BB	AA	AA	AA	AA
4	SNP_A-1721507	rs9307688	134441091	134.441091	0.726	BB	BB	AA	AA	AA	AA	AA	AA	BB	AB
4	SNP_A-1716218	rs9307703	135374277	135.374277	0.321	BB	BB	BB	BB	BB	BB	AB	AB	BB	BB
4	SNP_A-1719154	rs6535037	135968531	135.968531	0.691	AB	AB	AA	AA	AA	AA	AB	AB	AA	AB
4	SNP_A-1718316	rs10519369	137048788	137.048788	0.619	AB	AB	AA	AB	AB	AB	AB	AB	AA	AB
4	SNP_A-1643751	rs7692053	138020209	138.020209	0.631	AB	AB	BB	BB	BB	BB	AA	AA	AA	AA
4	SNP_A-1712218	rs1376088	139852726	139.852726	0.357	BB	BB	BB	BB	BB	BB	AB	AB	BB	BB
4	SNP_A-1688437	rs10519540	141950175	141.950175	0.429	AB	AB	BB	BB	BB	BB	AA	AB	AA	AB
4	SNP_A-1669152	rs2062597	143153292	143.153292	0.61	AA	AA	AA	AA	AA	AA	BB	BB	AA	AA
4	SNP_A-1651007	rs331963	144031456	144.031456	0.369	AA	AA	AB	AB	AB	AB	AA	AA	BB	AB
4	SNP_A-1705078	rs789351	146225975	146.225975	0.679	BB	BB	AA	AA	AA	AA	AA	AA	AA	AA
4	SNP_A-1700284	rs10519824	148107681	148.107681	0.658	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
4	SNP_A-1655082	rs6810951	149441717	149.441717	0.333	BB	BB	AB	AB	AB	AB	BB	AB	BB	BB
4	SNP_A-1650743	rs10489053	150276232	150.276232	0.643	AB	AB	AA	AA	AA	AA	AA	AA	AA	AB
4	SNP_A-1695870	rs991529	151852936	151.852936	0.488	BB	BB	BB	BB	BB	BB	AA	AA	AA	AA
4	SNP_A-1750768	rs361101	153131731	153.131731	0.631	BB	BB	AB	AB	AA	AB	AA	AA	BB	AB
4	SNP_A-1694614	rs7662116	154375569	154.375569	0.691	AA	AA	AA	AA	AA	AA	BB	AB	AA	AA
4	SNP_A-1651497	rs1125228	155126657	155.126657	0.738	AA	AA	BB	BB	BB	BB	BB	BB	BB	BB
4	SNP_A-1732214	rs6536240	158751762	158.751762	0.381	AB	AB	BB	BB	BB	BB	AB	AB	BB	AB
4	SNP_A-1721547	rs7678486	159498426	159.498426	0.25	BB	BB	BB	BB	BB	BB	BB	BB	AA	AB
4	SNP_A-1695472	rs7665879	160305968	160.305968	0.31	AB	AB	BB	BB	BB	BB	AB	AB	BB	AB
4	SNP_A-1653797	rs6856295	160845965	160.845965	0.595	BB	BB	AB	AB	AA	AB	AB	AB	AA	AA
4	SNP_A-1705238	rs9308000	161359479	161.359479	0.655	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
4	SNP_A-1679349	rs195894	163885040	163.88504	0.366	BB	BB	AB	AB	BB	AB	BB	BB	BB	BB
4	SNP_A-1719176	rs4057797	164602658	164.602658	0.381	BB	BB	AA	AA	AA	AA	BB	BB	BB	AB
4	SNP_A-1657975	rs4404502	165513434	165.513434	0.738	AA	AA	AA	AA	AA	AA	AB	AB	AA	AB
4	SNP_A-1669824	rs4691246	167437606	167.437606	0.402	BB	BB	AB	AB	AA	AB	AB	AB	BB	BB
4	SNP_A-1701924	rs7435411	169800826	169.800826	0.524	BB	BB	AB	AB	BB	AB	AB	AB	AA	AB
4	SNP_A-1673825	rs13212	170689681	170.689681	0.274	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
4	SNP_A-1736222	rs449424	171884933	171.884933	0.631	AA	AA	AB	AB	AA	AB	AA	AA	AA	AA
4	SNP_A-1745583	rs1485870	173125585	173.125585	0.744	BB	AB	AA	AA	AA	AA	AA	AA	AA	AA

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
4	SNP_A-1717120	rs10520252	174445689	174.445689	0.619	AA	AA	AB	AB	AA	AB	AB	AB	AA	AA
4	SNP_A-1714548	rs10520282	175752491	175.752491	0.738	AA	AA	AB	AB	AA	AB	AA	AA	AA	AA
4	SNP_A-1662283	rs393279	177816548	177.816548	0.488	AA	AA	BB	BB	BB	BB	BB	BB	BB	AB
4	SNP_A-1675843	rs10520383	178915654	178.915654	0.357	BB	BB	BB	BB	BB	BB	AB	AB	BB	AB
4	SNP_A-1737632	rs2706012	179727204	179.727204	0.718	AA	AA	AA	AA	AA	AA	AA	AA	BB	AB
4	SNP_A-1720252	rs10520430	180911694	180.911694	0.679	AA	AA	AB	AB	AA	AB	AA	AA	BB	BB
4	SNP_A-1644751	rs7667245	181665445	181.665445	0.695	AA	AB	AB	AB	BB	AB	AA	AA	AA	AA
4	SNP_A-1649573	rs10520479	182667862	182.667862	0.702	AA	AA	AA	AA	AA	AA	BB	BB	AA	AA
4	SNP_A-1689263	rs10520518	183365702	183.365702	0.369	BB	AB	AB	AB	BB	AB	AA	AA	BB	BB
4	SNP_A-1738928	rs830838	187288258	187.288258	0.333	BB	AB	BB	AB	AB	AB	BB	BB	AB	AB
4	SNP_A-1713082	rs1280100	187913282	187.913282	0.345	AA	AB	AA	AA	AA	AA	AB	AB	BB	BB
4	SNP_A-1654608	rs1505509	188945352	188.945352	0.345	AA	AB	BB	BB	BB	BB	AA	AA	BB	BB
4	SNP_A-1680395	rs2376743	189829781	189.829781	0.679	AA	AA	AA	AA	AA	AA	AB	AB	AB	AB
5	SNP_A-1689409	rs10512651	1816661	1.816661	0.405	BB	BB	AB	AB	BB	AB	AA	AA	AB	AB
5	SNP_A-1642488	rs1445862	3675257	3.675257	0.25	BB	BB	AB	AB	BB	AB	BB	AB	BB	BB
5	SNP_A-1651781	rs272190	5103830	5.10383	0.25	AB	AB	AA	AA	AA	AA	AB	AB	BB	BB
5	SNP_A-1663379	rs2560294	5619114	5.619114	0.726	AA	AA	AA	AA	AA	AA	AB	AB	AB	AB
5	SNP_A-1643560	rs10512858	6486915	6.486915	0.613	BB	BB	AB	AB	AB	AB	AA	AA	AB	AB
5	SNP_A-1651637	rs4629562	7847326	7.847326	0.619	AB	AB	AB	AB	AB	AB	AA	AA	AB	AB
5	SNP_A-1693207	rs9313236	8348429	8.348429	0.25	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
5	SNP_A-1744546	rs12515692	9883408	9.883408	0.357	AB	AB	BB	BB	BB	BB	BB	BB	AB	AB
5	SNP_A-1721268	rs2937513	11007551	11.007551	0.619	AB	AB	BB	BB	BB	BB	AB	AB	BB	BB
5	SNP_A-1702624	rs173671	12217918	12.217918	0.476	AB	AB	AB	BB	AB	AB	AB	AB	AA	AA
5	SNP_A-1695478	rs1476154	13000353	13.000353	0.691	BB	BB	AA	AA	AA	AA	AA	AA	AA	AA
5	SNP_A-1757294	rs3734108	13806984	13.806984	0.56	AA	AA	AB	BB	AB	AB	AB	AB	AB	AB
5	SNP_A-1696687	rs2938832	15817866	15.817866	0.25	AB	AB	BB	BB	BB	BB	AB	AB	AB	AB
5	SNP_A-1713461	rs585991	17246633	17.246633	0.274	BB	BB	AA	AA	AA	AA	BB	BB	BB	BB
5	SNP_A-1661473	rs1394215	18359538	18.359538	0.548	BB	BB	AA	AA	AA	AA	BB	BB	AA	AA
5	SNP_A-1646961	rs2942296	19421031	19.421031	0.429	BB	BB	AB	AA	AB	AB	AB	AB	AA	AA
5	SNP_A-1698916	rs248202	21159137	21.159137	0.274	BB	BB	BB	BB	BB	BB	AB	AB	AB	AB
5	SNP_A-1757332	rs7705523	23659025	23.659025	0.714	AA	AA	AB	BB	AB	AB	AA	AA	AB	AB
5	SNP_A-1672683	rs1995599	24552793	24.552793	0.548	AB	AB	AB	BB	AB	AB	BB	BB	AB	AB
5	SNP_A-1660984	rs9293241	26606178	26.606178	0.56	AB	AB	AA	AA	AA	AA	AB	AB	AB	AB
5	SNP_A-1704664	rs921469	29989233	29.989233	0.583	AB	AB	AA	AA	AA	AA	AA	AA	AB	AB
5	SNP_A-1644843	rs1921111	30906615	30.906615	0.405	BB	BB	BB	BB	BB	BB	AA	AA	AB	AB
5	SNP_A-1678791	rs893551	33493407	33.493407	0.607	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
5	SNP_A-1724049	rs716302	35846025	35.846025	0.357	AB	AB	AA	AA	AA	AA	AA	AB	BB	BB
5	SNP_A-1703432	rs159751	37035755	37.035755	0.464	AA	AA	BB	BB	BB	BB	BB	BB	AA	AA
5	SNP_A-1645375	rs4072686	38003109	38.003109	0.405	AB	AB	BB	BB	BB	BB	BB	BB	BB	AB
5	SNP_A-1719252	rs675502	39878266	39.878266	0.679	AB	AB	BB	BB	AA	AB	AA	AA	AA	AA
5	SNP_A-1685613	rs1697938	40890439	40.890439	0.441	AA	AA	AA	AA	AA	AA	BB	BB	AA	AA
5	SNP_A-1731232	rs276278	42016012	42.016012	0.298	BB	BB	BB	BB	BB	BB	BB	BB	BB	AB
5	SNP_A-1694450	rs1072746	43646445	43.646445	0.441	AA	AB	BB	BB	BB	BB	BB	AB	AA	AB
5	SNP_A-1675759	rs2404958	50098792	50.098792	0.619	AA	AB	AA	AA	BB	AB	AA	AA	AA	AA
5	SNP_A-1723309	rs9283709	51510492	51.510492	0.595	BB	AB	BB	BB	AB	AB	AA	AA	BB	BB
5	SNP_A-1728968	rs10512988	52085030	52.08503	0.357	BB	AB	AA	AA	AA	AA	BB	AB	AA	AA
5	SNP_A-1746984	rs9292039	53454075	53.454075	0.268	BB	BB	BB	BB	BB	BB	AA	AB	BB	AB
5	SNP_A-1697874	rs6450270	54287290	54.28729	0.714	AA	AA	AA	AA	AA	AA	BB	AB	AA	AA
5	SNP_A-1684501	rs889310	56000924	56.000924	0.476	BB	BB	AB	AA	AB	AB	BB	AB	AA	AB
5	SNP_A-1673657	rs2539731	57109292	57.109292	0.475	BB	BB	BB	BB	BB	BB	AB	AB	BB	BB
5	SNP_A-1716782	rs9292159	57677129	57.677129	0.31	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
5	SNP_A-1724117	rs9292180	58192447	58.192447	0.25	BB	BB	AB	AA	AB	AB	BB	BB	AA	AB
5	SNP_A-1755537	rs10514860	58859777	58.859777	0.726	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
5	SNP_A-1653871	rs6859376	59471964	59.471964	0.56	AA	AB	BB	BB	BB	BB	AB	AB	BB	BB
5	SNP_A-1653455	rs159375	60469024	60.469024	0.691	AA	AA	AA	AA	AA	AA	BB	BB	BB	AB
5	SNP_A-1682537	rs356598	63380121	63.380121	0.631	BB	BB	AA	AA	AA	AA	BB	BB	BB	AB
5	SNP_A-1755307	rs7704890	66151331	66.151331	0.357	AA	AB	BB	BB	BB	BB	BB	BB	AA	AB
5	SNP_A-1671457	rs6858907	67817289	67.817289	0.417	BB	BB	AB	BB	AB	AB	BB	BB	BB	BB
5	SNP_A-1654744	rs1600073	74472493	74.472493	0.61	BB	BB	AB	BB	AB	AB	AB	AB	AA	AA
5	SNP_A-1653531	rs10514059	75460983	75.460983	0.658	AA	AA	AA	AA	AA	AA	AA	AA	BB	BB
5	SNP_A-1720510	rs2972341	76504599	76.504599	0.536	AB	AB	AA	AA	AA	AA	AB	AB	AA	AB
5	SNP_A-1682839	rs949645	78478278	78.478278	0.564	AA	AA	AB	BB	AB	AB	BB	BB	AA	AB
5	SNP_A-1747624	rs264986	79206180	79.20618	0.31	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
5	SNP_A-1730614	rs964102	80843469	80.843469	0.679	AB	AB	AA	AA	AA	AA	AB	AB	BB	BB
5	SNP_A-1732246	rs10514249	82540612	82.540612	0.56	AA	AA	AA	AA	AA	AA	BB	AB	BB	BB
5	SNP_A-1729977	rs4639197	83381853	83.381853	0.25	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
5	SNP_A-1742238	rs323744	86861304	86.861304	0.5	BB	BB	AA	AA	AA	AA	BB	AB	AA	AB
5	SNP_A-1751644	rs819344	89093506	89.093506	0.463	AA	AA	AB	BB	AA	AB	BB	AB	BB	BB
5	SNP_A-1690642	rs2935499	89626568	89.626568	0.548	AA	AA	BB	BB	BB	BB	AA	AB	AB	AB
5	SNP_A-1744488	rs52308	90817903	90.817903	0.512	BB	BB	AA	AA	AA	AA	BB	BB	AA	AA
5	SNP_A-1670907	rs248339	95229134	95.229134	0.643	AA	AA	BB	BB	BB	BB	BB	AB	AB	AB
5	SNP_A-1729028	rs31248	96040439	96.040439	0.275	BB	BB	AB	BB	AA	AB	AA	AB	BB	BB

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
5	SNP_A-1657092	rs10515273	97821155	97.821155	0.75	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
5	SNP_A-1643346	rs2887526	98552712	98.552712	0.667	AB	AB	AA	AA	AA	AA	AA	AA	AA	AA
5	SNP_A-1722905	rs2369754	99184261	99.184261	0.488	AA	AA	AB	BB	AA	AB	AA	AB	BB	BB
5	SNP_A-1664073	rs1477625	101358141	101.358141	0.271	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
5	SNP_A-1742802	rs9327861	101895776	101.895776	0.655	BB	BB	AA	AA	AA	AA	BB	AB	AA	AA
5	SNP_A-1745283	rs39984	102625191	102.625191	0.31	AA	AA	BB	BB	BB	BB	AA	AA	BB	BB
5	SNP_A-1734843	rs10515355	103975436	103.975436	0.738	AB	AB	AA	AA	AA	AA	BB	BB	AA	AA
5	SNP_A-1730932	rs4957531	106511277	106.511277	0.463	AA	AA	AA	AA	AA	AA	AA	AB	AB	AB
5	SNP_A-1757418	rs245243	109258634	109.258634	0.714	AB	AB	AB	AA	BB	AB	AA	AB	AA	AA
5	SNP_A-1646761	rs10491424	110481705	110.481705	0.56	BB	BB	AB	AB	BB	AB	AA	AA	AA	AA
5	SNP_A-1691719	rs1213404	111130917	111.130917	0.35	BB	BB	BB	BB	BB	BB	BB	AB	BB	BB
5	SNP_A-1747768	rs971517	112050154	112.050154	0.476	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
5	SNP_A-1726679	rs10519378	113555966	113.555966	0.738	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
5	SNP_A-1738592	rs2546480	114841054	114.841054	0.452	AB	AB	BB	BB	BB	BB	BB	BB	AB	AB
5	SNP_A-1708792	rs2662458	115402242	115.402242	0.655	AB	AB	AB	AB	BB	AB	AA	AA	AB	AB
5	SNP_A-1720512	rs1027292	116078486	116.078486	0.548	BB	BB	AA	AA	AA	AA	AA	AA	AB	AB
5	SNP_A-1701708	rs1504978	118638459	118.638459	0.655	AB	AB	AB	AB	AA	AB	AA	AA	AA	AA
5	SNP_A-1689317	rs10519615	119189176	119.189176	0.643	BB	BB	BB	BB	BB	BB	AB	AB	AB	AB
5	SNP_A-1751260	rs6897147	119692229	119.692229	0.691	AA	AA	AA	AA	AA	AA	BB	BB	AA	AA
5	SNP_A-1654688	rs161011	123703275	123.703275	0.286	AA	AA	AB	AB	AB	AB	BB	BB	BB	BB
5	SNP_A-1699578	rs7716491	124265772	124.265772	0.738	AB	AB	AA	AA	AA	AA	AB	AB	AB	AB
5	SNP_A-1703238	rs1826263	124839517	124.839517	0.571	BB	BB	AA	AA	AA	AA	AB	AB	AB	AB
5	SNP_A-1715428	rs964185	125631547	125.631547	0.345	AA	AA	AB	AB	AB	AB	BB	BB	AB	AB
5	SNP_A-1751090	rs1345663	126678081	126.678081	0.31	BB	AB	AA	AA	AA	AA	AA	AA	AA	AA
5	SNP_A-1694738	rs9327460	127338947	127.338947	0.524	AA	AA	AA	AA	AA	AA	AB	AB	BB	BB
5	SNP_A-1658519	rs1181962	128414700	128.4147	0.333	BB	BB	AA	AA	AA	AA	AB	AB	BB	BB
5	SNP_A-1677377	rs25810	129015788	129.015788	0.595	AA	AA	AA	AA	AA	AA	AA	AA	AB	AB
5	SNP_A-1673843	rs10520083	129967905	129.967905	0.345	AA	AA	AB	AB	AB	AB	AB	AB	AB	AB
5	SNP_A-1705560	rs9327673	133230970	133.23097	0.286	BB	BB	BB	BB	BB	BB	AB	AB	AB	AB
5	SNP_A-1662391	rs10515473	134961986	134.961986	0.714	BB	AB	AA	AA	AA	AA	AA	AA	AB	AB
5	SNP_A-1707797	rs10515481	136007946	136.007946	0.536	BB	AB	AA	AA	AA	AA	AA	AA	BB	BB
5	SNP_A-1720076	rs1560930	136590879	136.590879	0.537	BB	BB	AA	AA	AA	AA	AA	AA	AB	AB
5	SNP_A-1697724	rs288019	138219292	138.219292	0.39	BB	BB	AB	AB	AB	AB	BB	AB	BB	BB
5	SNP_A-1707038	rs2336977	139130436	139.130436	0.61	AA	AB	AB	AB	AB	AB	BB	AB	AA	AA
5	SNP_A-1703312	rs6860077	139725338	139.725338	0.31	BB	AB	BB	BB	BB	BB	BB	BB	AB	AB
5	SNP_A-1742086	rs246002	140321288	140.321288	0.5	BB	BB	AB	AB	AB	AB	AA	AB	AA	AA

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
5	SNP_A-1730974	rs32927	141102251	141.102251	0.298	AA	AB	BB	BB	BB	BB	BB	AB	AB	AB
5	SNP_A-1736416	rs997833	141815738	141.815738	0.286	AA	AB	AB	AB	AB	AB	BB	BB	BB	BB
5	SNP_A-1722681	rs325227	143131067	143.131067	0.31	AA	AB	AA	AA	AA	AA	AA	AA	BB	BB
5	SNP_A-1749482	rs10515600	147316068	147.316068	0.548	AB	AB	AB	AB	AB	AB	AA	AA	BB	BB
5	SNP_A-1716760	rs185021	148147283	148.147283	0.524	AB	AB	AB	AB	AB	AB	BB	BB	AA	AA
5	SNP_A-1642124	rs10515632	149082624	149.082624	0.333	BB	BB	AB	AB	AB	AB	BB	AB	AA	AA
5	SNP_A-1737743	rs1277464	150234035	150.234035	0.354	BB	BB	AB	AB	AB	AB	AB	AB	BB	BB
5	SNP_A-1678329	rs2304054	150923278	150.923278	0.548	AB	AB	AA	AA	AA	AA	BB	BB	AB	AB
5	SNP_A-1649583	rs10515686	152529312	152.529312	0.619	AA	AA	AB	AB	AB	AB	BB	AB	AB	AB
5	SNP_A-1652471	rs4129128	153102070	153.10207	0.321	AB	AB	AA	AA	AA	AA	BB	AB	BB	BB
5	SNP_A-1700286	rs991314	154438135	154.438135	0.744	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
5	SNP_A-1752802	rs2569031	155177249	155.177249	0.488	AB	AB	AB	AB	AB	AB	AA	AA	AB	AB
5	SNP_A-1706578	rs873343	157106698	157.106698	0.25	AB	AB	AB	AB	AB	AB	AA	AA	BB	BB
5	SNP_A-1757398	rs9313777	157878177	157.878177	0.75	AA	AA	AA	AA	AA	AA	AA	AA	AB	AB
5	SNP_A-1736540	rs10515781	158633942	158.633942	0.321	AB	AB	AB	AB	AB	AB	BB	BB	BB	BB
5	SNP_A-1647073	rs411005	160517741	160.517741	0.476	AB	AB	AA	AA	AA	AA	BB	BB	AA	AA
5	SNP_A-1724235	rs2170901	161840216	161.840216	0.429	BB	BB	AB	AB	AB	AB	BB	BB	AA	AA
5	SNP_A-1754048	rs300238	162682948	162.682948	0.452	AB	AB	AB	AB	AB	AB	AA	AA	AB	AB
5	SNP_A-1745987	rs158295	163217790	163.21779	0.25	BB	BB	BB	BB	BB	BB	AA	AB	BB	BB
5	SNP_A-1720394	rs6869856	166017651	166.017651	0.412	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
5	SNP_A-1687531	rs1911557	169681232	169.681232	0.25	BB	BB	BB	BB	BB	BB	AB	AB	AB	AB
5	SNP_A-1749300	rs10516089	171083836	171.083836	0.726	AB	AB	AA	AA	AA	AA	AB	AB	AA	AA
5	SNP_A-1665975	rs1909706	173644330	173.64433	0.707	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
5	SNP_A-1724885	rs965017	174509108	174.509108	0.548	AB	AB	AB	AB	BB	AA	AA	AA	AA	AA
5	SNP_A-1644515	rs1071882	178068646	178.068646	0.702	AA	AA	AB	AB	AA	AB	AA	AA	AA	AA
5	SNP_A-1748220	rs2892344	180297919	180.297919	0.536	AB	AB	BB	BB	BB	BB	BB	BB	AB	AB
6	SNP_A-1732501	rs3765437	508013	0.508013	0.536	AA	AA	BB	BB	BB	BB	BB	BB	AA	AA
6	SNP_A-1728682	rs238073	1192930	1.19293	0.381	AA	AA	BB	BB	BB	BB	AA	AA	AB	AB
6	SNP_A-1747718	rs6919059	1729095	1.729095	0.691	AA	AB	AA	AA	AA	AA	AB	AB	AA	AA
6	SNP_A-1723553	rs2326366	3923256	3.923256	0.417	BB	AB	AA	AB	AA	AB	BB	BB	AB	AB
6	SNP_A-1747058	rs10484314	5593086	5.593086	0.333	BB	BB	BB	BB	BB	BB	BB	BB	AB	AB
6	SNP_A-1673883	rs3851514	6219569	6.219569	0.75	BB	BB	BB	AB	BB	AB	AB	AB	AA	AA
6	SNP_A-1737825	rs267202	7799235	7.799235	0.619	AB	AB	AA	AB	AA	AB	AA	AA	AA	AA
6	SNP_A-1680945	rs1543731	8355978	8.355978	0.346	AA	AA	AA	AB	AA	AB	BB	BB	BB	BB
6	SNP_A-1702006	rs9296701	9687981	9.687981	0.536	AB	AB	BB	BB	BB	BB	BB	BB	AB	AB
6	SNP_A-1715186	rs4512212	10379387	10.379387	0.464	BB	BB	AA	AB	AA	AB	BB	BB	BB	BB

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
6	SNP_A-1680453	rs2182335	11324963	11.324963	0.714	AA	AA	AA	AB	AA	AB	BB	BB	AA	AA
6	SNP_A-1690060	rs2841555	13574809	13.574809	0.655	AA	AA	AA	AA	AA	AA	AB	AB	AB	AB
6	SNP_A-1646375	rs2237166	16755137	16.755137	0.536	AB	AB	AB	AB	BB	AB	BB	BB	AA	AA
6	SNP_A-1744270	rs2147211	17898170	17.89817	0.714	AA	AA	AA	AA	AA	AA	AB	AB	AB	AB
6	SNP_A-1679405	rs9297090	18873893	18.873893	0.571	AB	AB	AA	AA	AA	AA	AA	AA	AB	AB
6	SNP_A-1717924	rs971623	20437442	20.437442	0.405	AB	AB	BB	BB	BB	BB	AB	AB	BB	BB
6	SNP_A-1749068	rs10485012	22715005	22.715005	0.595	AB	AB	AB	AB	AB	AB	BB	BB	AA	AA
6	SNP_A-1754953	rs2022330	23554534	23.554534	0.667	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB
6	SNP_A-1698352	rs499466	24069410	24.06941	0.5	AB	AB	BB	BB	BB	BB	AB	AB	AA	AA
6	SNP_A-1682833	rs9295755	28141153	28.141153	0.25	BB	BB	BB	BB	BB	BB	AB	AB	BB	BB
6	SNP_A-1656688	rs2747430	29756485	29.756485	0.702	AB	AB	AA	AA	AA	AA	AA	AA	AA	AA
6	SNP_A-1715492	rs2395173	32512837	32.512837	0.691	AB	AB	AA	AA	AA	AA	AB	AB	AA	AA
6	SNP_A-1722893	rs9296266	38990614	38.990614	0.573	AA	AA	AB	AB	AB	AB	AA	AA	AA	AB
6	SNP_A-1724965	rs2395743	40400147	40.400147	0.488	BB	AB	BB	BB	BB	BB	BB	BB	BB	AB
6	SNP_A-1757782	rs3804281	41853967	41.853967	0.429	BB	BB	AB	AB	AB	AB	AA	AB	BB	BB
6	SNP_A-1700088	rs3763234	42725939	42.725939	0.298	AA	AB	BB	BB	BB	BB	BB	BB	BB	AB
6	SNP_A-1748380	rs525043	44511878	44.511878	0.25	BB	BB	BB	BB	BB	BB	BB	BB	BB	AB
6	SNP_A-1685295	rs9296453	45335410	45.33541	0.429	AA	AB	BB	BB	BB	BB	AA	AA	AA	AA
6	SNP_A-1708722	rs9296468	45876662	45.876662	0.726	AA	AA	AB	AB	AB	AB	AA	AA	AA	AA
6	SNP_A-1736458	rs10498767	46471516	46.471516	0.441	BB	AB	BB	BB	BB	BB	BB	BB	BB	AB
6	SNP_A-1642956	rs9296547	47474339	47.474339	0.643	AA	AA	BB	BB	BB	BB	BB	AB	AA	AA
6	SNP_A-1742558	rs2089505	48229201	48.229201	0.643	AA	AA	BB	BB	BB	BB	BB	BB	AA	AA
6	SNP_A-1738582	rs504213	49411897	49.411897	0.607	AA	AA	AA	AA	AA	AA	AA	AA	BB	AB
6	SNP_A-1658085	rs10484664	51124482	51.124482	0.256	BB	BB	BB	BB	BB	BB	BB	BB	BB	AB
6	SNP_A-1723157	rs913098	51750772	51.750772	0.667	AA	AB	AA	AA	AA	AA	AA	AA	AA	AA
6	SNP_A-1726221	rs509946	52411949	52.411949	0.369	BB	BB	AA	BB	AA	AB	BB	AB	BB	BB
6	SNP_A-1717116	rs10484785	53457958	53.457958	0.476	BB	AB	BB	BB	BB	BB	AA	AB	BB	BB
6	SNP_A-1717814	rs1393779	54808762	54.808762	0.464	AA	AB	AA	AA	AA	AA	BB	BB	BB	BB
6	SNP_A-1693069	rs1925179	56129171	56.129171	0.655	AA	AA	AA	AA	AA	AA	AA	AA	AA	AB
6	SNP_A-1664153	rs6934928	58422082	58.422082	0.714	BB	AB	AA	AA	AA	AA	BB	AB	AA	AA
6	SNP_A-1682123	rs565795	62597708	62.597708	0.61	AA	AA	AA	AA	AA	AA	BB	BB	AA	AB
6	SNP_A-1692597	rs9293849	63255396	63.255396	0.333	BB	BB	BB	AA	BB	AB	AA	AB	BB	AB
6	SNP_A-1729072	rs9294630	65677619	65.677619	0.702	AA	AB	AA	AA	AA	AA	AA	AA	AA	AB
6	SNP_A-1685655	rs2502270	67886666	67.886666	0.488	AA	AA	AA	AA	AA	AA	AB	AB	AA	AA
6	SNP_A-1744006	rs4707479	68787830	68.78783	0.286	AA	AA	BB	BB	BB	BB	BB	BB	BB	AB
6	SNP_A-1683273	rs579588	69639537	69.639537	0.714	AA	AA	BB	AA	BB	AB	AB	AB	BB	AA

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
6	SNP_A-1659091	rs591809	72270133	72.270133	0.524	BB	BB	BB	BB	BB	BB	BB	BB	AA	AB
6	SNP_A-1660794	rs959369	74620278	74.620278	0.607	AA	AA	AA	AA	AA	AA	AA	AA	AA	AB
6	SNP_A-1656648	rs1575856	76774483	76.774483	0.262	BB	BB	BB	BB	BB	BB	BB	BB	BB	AB
6	SNP_A-1675424	rs1457947	77533004	77.533004	0.619	AA	AA	AA	AA	AA	AA	AB	AB	AA	AA
6	SNP_A-1657250	rs236225	79172654	79.172654	0.744	AA	AA	AA	AA	AA	AA	AB	AB	AA	AA
6	SNP_A-1646741	rs239500	80761863	80.761863	0.595	AB	AB	AA	AA	AA	AA	AB	AB	BB	BB
6	SNP_A-1733643	rs310387	81832380	81.83238	0.56	AA	AA	AA	AA	AA	AA	AA	AA	BB	AB
6	SNP_A-1684117	rs2323435	82365338	82.365338	0.417	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
6	SNP_A-1749278	rs958568	83211843	83.211843	0.417	BB	BB	BB	BB	BB	BB	AB	AB	BB	AB
6	SNP_A-1737476	rs6938512	85412591	85.412591	0.476	AB	AB	BB	BB	BB	BB	AA	AA	BB	BB
6	SNP_A-1658179	rs3966882	85938190	85.93819	0.46	BB	BB	BB	AA	AB	AB	AB	AB	BB	BB
6	SNP_A-1704672	rs3857488	88057783	88.057783	0.548	AB	AB	BB	BB	BB	BB	AA	AA	AA	AB
6	SNP_A-1750678	rs942115	90274825	90.274825	0.691	AA	AA	BB	BB	BB	BB	AA	AA	AA	AA
6	SNP_A-1641794	rs1753826	91283465	91.283465	0.274	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
6	SNP_A-1747902	rs427118	92400922	92.400922	0.622	AB	AB	AA	AA	AA	AA	AA	AA	AB	AB
6	SNP_A-1699604	rs609590	93182864	93.182864	0.595	AB	AB	AA	AA	AA	AA	AB	AB	AB	AB
6	SNP_A-1671865	rs1906966	94362973	94.362973	0.571	AA	AA	AA	AA	AA	AA	AB	AB	AB	AB
6	SNP_A-1672477	rs2380218	95947837	95.947837	0.643	AB	AB	BB	AB	AB	AB	AB	AB	AA	AA
6	SNP_A-1727169	rs6925466	96483564	96.483564	0.476	AB	AB	AA	AB	AB	AB	BB	BB	AB	AB
6	SNP_A-1669372	rs2206094	97681917	97.681917	0.595	AB	AB	AA	AA	AA	AA	AB	AB	AB	AB
6	SNP_A-1754567	rs10484477	103889951	103.889951	0.738	AA	AA	AA	AA	AA	AA	BB	BB	AB	AB
6	SNP_A-1687147	rs1341123	104971433	104.971433	0.274	BB	BB	BB	BB	BB	BB	BB	BB	AB	AB
6	SNP_A-1696467	rs1325421	105998201	105.998201	0.643	AB	AB	AA	AB	AB	AB	AA	AA	AA	AA
6	SNP_A-1733167	rs1462145	107068713	107.068713	0.357	AB	AB	BB	BB	BB	BB	BB	BB	BB	BB
6	SNP_A-1650105	rs7740028	110825873	110.825873	0.393	AA	AA	BB	BB	BB	BB	AA	AA	BB	BB
6	SNP_A-1680493	rs2010315	112529340	112.52934	0.679	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
6	SNP_A-1735595	rs1378682	113188320	113.18832	0.405	AA	AA	BB	BB	BB	BB	AA	AA	AB	AB
6	SNP_A-1712634	rs2810160	114329403	114.329403	0.548	AA	AB	BB	BB	BB	BB	AB	AB	AB	AB
6	SNP_A-1687581	rs1748168	114955404	114.955404	0.56	BB	AB	AA	AA	AA	AA	AB	AB	BB	BB
6	SNP_A-1738139	rs2250263	116940700	116.9407	0.679	AA	AB	AA	AA	AA	AA	AA	AA	BB	BB
6	SNP_A-1729937	rs929122	117712442	117.712442	0.726	AA	AA	AA	AA	AA	AA	AA	AA	AB	AB
6	SNP_A-1661803	rs9285429	118811259	118.811259	0.619	AA	AA	AB	AB	AB	AB	AA	AA	BB	BB
6	SNP_A-1665123	rs1873553	120164641	120.164641	0.429	BB	BB	BB	BB	BB	BB	AB	AB	AA	AA
6	SNP_A-1679087	rs6906196	122713901	122.713901	0.369	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
6	SNP_A-1707510	rs6924068	124232587	124.232587	0.345	BB	BB	AB	AB	AB	AB	BB	BB	BB	BB
6	SNP_A-1745119	rs484510	125528599	125.528599	0.691	AA	AA	AA	AA	AA	AA	AA	AA	AB	AB

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
6	SNP_A-1685381	rs9321057	126198636	126.198636	0.405	AA	AB	BB	BB	BB	BB	AB	AB	AB	AB
6	SNP_A-1751986	rs270044	128228176	128.228176	0.405	AA	AB	BB	BB	BB	BB	BB	BB	AB	AB
6	SNP_A-1721422	rs1508439	129073191	129.073191	0.655	AA	AB	AA	AA	AA	AA	AB	AB	AA	AA
6	SNP_A-1707720	rs10484282	130107771	130.107771	0.321	BB	AB	BB	BB	BB	BB	AB	AB	BB	BB
6	SNP_A-1652817	rs766967	130912718	130.912718	0.488	AA	AA	AB	AB	AB	AB	AB	AB	BB	BB
6	SNP_A-1653251	rs170881	132358254	132.358254	0.655	AA	AA	BB	BB	BB	BB	AB	AB	BB	BB
6	SNP_A-1723663	rs2745426	133045037	133.045037	0.287	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
6	SNP_A-1751418	rs509904	133558775	133.558775	0.713	AA	AB	AA	AA	AA	AA	AA	AA	BB	BB
6	SNP_A-1735812	rs6570091	137092589	137.092589	0.464	BB	BB	AA	AA	AA	AA	BB	BB	AB	AB
6	SNP_A-1669540	rs662100	137931606	137.931606	0.512	AA	AA	AA	AA	AA	AA	BB	AB	AA	AA
6	SNP_A-1692831	rs2473522	139472945	139.472945	0.274	BB	BB	AB	AB	AB	AB	AA	AA	BB	BB
6	SNP_A-1729139	rs9321743	140005650	140.00565	0.655	AA	AA	AA	AA	AA	AA	AA	AA	AB	AB
6	SNP_A-1668519	rs225710	142582952	142.582952	0.548	AB	AB	BB	BB	BB	BB	BB	AB	AA	AA
6	SNP_A-1741850	rs10484804	143972461	143.972461	0.262	AB	AB	BB	BB	BB	BB	BB	BB	BB	BB
6	SNP_A-1699598	rs4243477	145767511	145.767511	0.655	AA	AA	AA	AA	AA	AA	AA	AB	AB	AB
6	SNP_A-1714061	rs6923545	146286436	146.286436	0.417	AB	AB	BB	BB	BB	BB	BB	AB	AB	AB
6	SNP_A-1643757	rs2025157	146851348	146.851348	0.607	AA	AA	AA	AA	AA	AA	AA	AB	BB	BB
6	SNP_A-1746680	rs10484677	148334072	148.334072	0.702	AA	AA	AA	AA	AA	AA	AA	AA	AB	AB
6	SNP_A-1674099	rs997682	149708313	149.708313	0.293	BB	BB	AB	AB	AB	AB	BB	AB	BB	BB
6	SNP_A-1742378	rs1933079	151696424	151.696424	0.464	AA	AA	BB	BB	BB	BB	AA	AB	BB	BB
6	SNP_A-1664463	rs872371	153469676	153.469676	0.732	AA	AA	BB	BB	BB	BB	AA	AB	AA	AA
6	SNP_A-1706738	rs612450	154306471	154.306471	0.56	AB	AB	AA	AB	AB	AB	AA	AA	AA	AA
6	SNP_A-1661002	rs1980602	155248334	155.248334	0.429	AB	AB	AA	AA	AA	AA	BB	AB	AB	AB
6	SNP_A-1700465	rs1391655	156092837	156.092837	0.298	BB	AB	BB	BB	BB	BB	BB	AB	BB	BB
6	SNP_A-1660620	rs7770496	156806897	156.806897	0.372	AA	AB	AA	AB	AB	AB	AA	AB	AB	AB
6	SNP_A-1712976	rs4709298	157885415	157.885415	0.262	BB	AB	BB	AB	AB	AB	AA	AB	AA	AA
6	SNP_A-1676117	rs7753885	158892133	158.892133	0.488	BB	AB	AA	AB	AB	AB	BB	BB	BB	BB
6	SNP_A-1669774	rs923459	159532261	159.532261	0.513	BB	AB	AA	AA	AA	AA	BB	BB	AB	AB
6	SNP_A-1659978	rs927450	160152507	160.152507	0.583	AA	AA	AA	AA	AA	AA	BB	AB	AB	AB
6	SNP_A-1670969	rs598969	160664317	160.664317	0.425	BB	AB	AA	AA	AA	AA	BB	BB	BB	BB
6	SNP_A-1697554	rs6910079	164339862	164.339862	0.441	AA	AB	BB	AB	AB	AB	BB	BB	AB	AB
6	SNP_A-1641972	rs907223	165179009	165.179009	0.702	AA	AA	AA	AA	AA	AA	AA	AA	AB	AB
6	SNP_A-1698488	rs162293	167420582	167.420582	0.75	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
7	SNP_A-1647507	rs1637750	2001052	2.001052	0.655	AA	AA	AA	AA	AA	AA	AB	AB	AA	AA
7	SNP_A-1710599	rs10257982	3107838	3.107838	0.452	AA	AB	AA	AA	AA	AA	BB	BB	AB	AB
7	SNP_A-1675597	rs10488360	4184450	4.18445	0.317	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
7	SNP_A-1712104	rs719423	7128355	7.128355	0.667	AA	AA	BB	BB	BB	BB	BB	BB	AB	AB
7	SNP_A-1649251	rs38012	7815795	7.815795	0.464	AB	AB	AB	AB	BB	AB	AB	AB	AB	AB
7	SNP_A-1714013	rs10253058	10364900	10.3649	0.738	AA	AA	AA	AA	AA	AA	AA	AA	AB	AB
7	SNP_A-1656052	rs7785008	10921568	10.921568	0.452	AB	AB	BB	BB	BB	BB	AA	AA	AB	AB
7	SNP_A-1678735	rs10270630	11629477	11.629477	0.738	BB	BB	AB	AB	BB	AB	AA	AA	AB	AB
7	SNP_A-1672885	rs1036667	12197823	12.197823	0.488	BB	BB	AB	AB	AA	AB	AA	AA	AA	AA
7	SNP_A-1707354	rs2214867	13507965	13.507965	0.417	AA	AA	AA	AA	AA	AA	BB	BB	AB	AB
7	SNP_A-1724539	rs7793372	14320689	14.320689	0.619	BB	BB	BB	BB	BB	BB	AA	AA	AB	AB
7	SNP_A-1756798	rs1527203	15931001	15.931001	0.643	AA	AA	AB	AB	AB	AB	AA	AA	AA	AA
7	SNP_A-1755023	rs706057	16577230	16.57723	0.56	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB
7	SNP_A-1647845	rs4721619	17291814	17.291814	0.667	AB	AB	AA	AA	AA	AA	AB	AB	AA	AA
7	SNP_A-1693824	rs2731551	18050825	18.050825	0.25	BB	BB	AB	AB	AB	AB	BB	BB	BB	BB
7	SNP_A-1724213	rs10486334	18974842	18.974842	0.726	BB	BB	AB	AB	AB	AB	BB	BB	AA	AA
7	SNP_A-1716746	rs2248634	21065118	21.065118	0.262	BB	BB	BB	BB	BB	BB	AB	AB	BB	BB
7	SNP_A-1706218	rs7781044	21636203	21.636203	0.61	AA	AA	AA	AA	AA	AA	AB	AB	AB	AB
7	SNP_A-1718088	rs2286497	22701238	22.701238	0.305	BB	BB	AB	AB	AB	AB	AB	AB	AB	AB
7	SNP_A-1755947	rs2521642	24200036	24.200036	0.31	BB	BB	BB	BB	BB	BB	AB	AB	BB	BB
7	SNP_A-1751950	rs4275130	26366016	26.366016	0.75	AB	AB	AA	AA	AA	AA	AA	AA	AA	AA
7	SNP_A-1725907	rs6953785	27237607	27.237607	0.536	AB	AB	AB	BB	AB	AB	AB	AB	AA	AA
7	SNP_A-1729503	rs4498447	28177012	28.177012	0.524	BB	BB	AB	BB	AB	AB	BB	BB	AB	AB
7	SNP_A-1663287	rs1859681	28699408	28.699408	0.275	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
7	SNP_A-1728544	rs1476991	29293282	29.293282	0.571	AA	AA	AA	AA	AA	AA	AA	AA	AB	AB
7	SNP_A-1718026	rs997349	29955684	29.955684	0.357	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
7	SNP_A-1695134	rs10487729	31345524	31.345524	0.726	AA	AA	AA	AA	AA	AA	AB	AB	BB	BB
7	SNP_A-1694740	rs215675	32156237	32.156237	0.286	AA	AB	BB	BB	BB	BB	BB	BB	AB	AB
7	SNP_A-1717858	rs10254116	33010729	33.010729	0.631	BB	AB	AA	AA	AA	AA	AA	AA	AA	AA
7	SNP_A-1678175	rs10486619	33600838	33.600838	0.262	BB	BB	BB	BB	BB	BB	BB	BB	AB	AB
7	SNP_A-1749566	rs741202	35093154	35.093154	0.262	BB	BB	BB	BB	AB	AB	BB	BB	AA	AA
7	SNP_A-1731924	rs4720228	36725169	36.725169	0.476	BB	AB	BB	BB	BB	BB	BB	BB	BB	BB
7	SNP_A-1671783	rs2893552	37928803	37.928803	0.679	AA	AA	AA	AA	AA	AA	BB	BB	AA	AA
7	SNP_A-1730217	rs4723791	38613746	38.613746	0.56	BB	AB	AA	AA	AA	AA	AA	AA	AA	AA
7	SNP_A-1669882	rs10486802	39497008	39.497008	0.571	AA	AA	BB	BB	BB	BB	AA	AA	AA	AA
7	SNP_A-1721388	rs7807596	40599281	40.599281	0.417	AA	AA	BB	BB	AB	AB	AB	AB	AA	AA
7	SNP_A-1750290	rs384469	41099793	41.099793	0.702	AA	AB	AA	AA	AA	AA	AB	AB	AA	AA
7	SNP_A-1695614	rs721273	42867596	42.867596	0.702	AA	AA	BB	BB	AB	AB	AA	AA	AA	AA
7	SNP_A-1736506	rs2330918	43444472	43.444472	0.75	AA	AB	AA	AA	AA	AA	AA	AA	AA	AA

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
7	SNP_A-1732094	rs10253161	46769632	46.769632	0.714	AA	AA	AA	AA	AA	AA	AA	AA	BB	AB
7	SNP_A-1710294	rs7357251	47841498	47.841498	0.417	AA	AA	AA	AA	AA	AB	BB	BB	BB	BB
7	SNP_A-1669906	rs3923511	48463293	48.463293	0.688	AA	AA	AA	AA	AA	AA	AB	AB	BB	AB
7	SNP_A-1748806	rs716719	50102978	50.102978	0.262	AA	AA	BB	BB	BB	BB	BB	BB	BB	BB
7	SNP_A-1646085	rs2159809	52287324	52.287324	0.39	AA	AB	BB	BB	BB	BB	BB	BB	BB	BB
7	SNP_A-1655668	rs6955211	63316490	63.31649	0.464	BB	AB	AA	AA	AA	AA	AA	AB	BB	BB
7	SNP_A-1695272	rs9638255	67214110	67.21411	0.655	AA	AA	AA	AA	AA	AA	AA	AB	AA	AA
7	SNP_A-1673105	rs1699443	68224124	68.224124	0.583	AA	AB	AA	AA	AA	AA	AA	AA	BB	AB
7	SNP_A-1667673	rs10499812	69098641	69.098641	0.333	AA	AB	BB	BB	BB	BB	BB	BB	BB	BB
7	SNP_A-1757146	rs6976144	77019455	77.019455	0.5	AA	AB	BB	BB	BB	BB	AB	AB	AA	AB
7	SNP_A-1741890	rs10485887	77712706	77.712706	0.548	AA	AA	AA	AB	AA	AB	BB	BB	AA	AB
7	SNP_A-1663217	rs984312	78285441	78.285441	0.631	AA	AA	BB	AB	AB	AB	AA	AA	BB	AB
7	SNP_A-1676663	rs3211816	79922641	79.922641	0.39	BB	BB	BB	BB	BB	BB	AB	AB	BB	BB
7	SNP_A-1724625	rs3801720	81447606	81.447606	0.595	AA	AB	BB	AB	AB	AB	AB	AB	BB	AB
7	SNP_A-1701440	rs1693380	82818863	82.818863	0.738	AA	AA	AA	AA	AA	AA	AB	AB	AA	AA
7	SNP_A-1690947	rs10499889	84765715	84.765715	0.369	BB	BB	BB	BB	BB	BB	AB	AB	AA	AA
7	SNP_A-1722683	rs1063964	87480120	87.48012	0.607	AA	AA	AA	AA	AA	AA	AA	AA	BB	AB
7	SNP_A-1697794	rs7799830	88761617	88.761617	0.429	BB	BB	AA	AA	AA	AA	AB	AB	AA	AA
7	SNP_A-1692549	rs3802029	90126750	90.12675	0.595	AB	AB	AA	AB	AB	AB	BB	BB	BB	AB
7	SNP_A-1721485	rs1468180	92759526	92.759526	0.441	BB	BB	AA	AA	AA	AA	AA	AA	AA	AB
7	SNP_A-1705566	rs6465448	94217939	94.217939	0.548	AB	AB	BB	BB	BB	BB	AA	AA	BB	AB
7	SNP_A-1644895	rs1403179	96113755	96.113755	0.75	AB	AB	AA	AA	AA	AA	AB	AB	AA	AA
7	SNP_A-1698924	rs7779090	96790254	96.790254	0.345	BB	BB	BB	BB	BB	BB	AB	AB	BB	AB
7	SNP_A-1755481	rs2572009	99133656	99.133656	0.524	AA	AA	BB	AB	AB	AB	AA	AA	AA	AA
7	SNP_A-1669180	rs10487284	102064226	102.064226	0.667	AA	AA	AA	AA	AA	AA	AA	AA	AA	AB
7	SNP_A-1730488	rs10487162	102860400	102.8604	0.256	AB	AB	BB	AB	AB	AB	BB	BB	BB	AB
7	SNP_A-1715320	rs2519681	105578447	105.578447	0.369	AB	AB	AA	AB	AB	AB	AB	AB	AA	AB
7	SNP_A-1657867	rs997381	106280867	106.280867	0.524	AB	AB	BB	BB	BB	BB	AA	AA	BB	BB
7	SNP_A-1703262	rs3801948	106832398	106.832398	0.643	AA	AA	BB	AB	AB	AB	AA	AA	BB	AB
7	SNP_A-1687475	rs1015422	107930809	107.930809	0.298	BB	AB	AA	AB	AB	AB	AB	AB	BB	AB
7	SNP_A-1643849	rs2106442	108493824	108.493824	0.476	AA	AA	BB	BB	BB	BB	AB	AB	AA	AA
7	SNP_A-1688527	rs10487320	109537858	109.537858	0.619	BB	AB	BB	BB	BB	BB	AA	AB	AA	AA
7	SNP_A-1641802	rs10500003	110076704	110.076704	0.702	AA	AB	AA	AA	AA	AA	AA	AA	AA	AA
7	SNP_A-1740412	rs10487331	110945463	110.945463	0.726	AA	AA	AA	AB	AB	AB	BB	AB	AA	AB
7	SNP_A-1745955	rs2529588	111697006	111.697006	0.726	AA	AA	AA	AA	AA	AA	AA	AB	AA	AB
7	SNP_A-1724315	rs1548395	112947523	112.947523	0.298	BB	BB	BB	BB	BB	BB	BB	AB	AA	AB

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
7	SNP_A-1719538	rs6973150	114297804	114.297804	0.45	BB	BB	AB	AB	AB	AB	BB	BB	BB	BB
7	SNP_A-1736164	rs10500054	115247129	115.247129	0.5	BB	BB	BB	BB	BB	BB	AA	AB	BB	BB
7	SNP_A-1733815	rs7783832	116468422	116.468422	0.298	BB	BB	AB	AB	AB	AB	BB	AB	BB	AB
7	SNP_A-1676935	rs10487392	117466579	117.466579	0.488	BB	BB	AB	AB	AB	AB	AA	AA	AA	AB
7	SNP_A-1647647	rs10488301	119761267	119.761267	0.262	AA	AB	BB	BB	BB	BB	AA	AB	BB	BB
7	SNP_A-1655036	rs1206486	121146345	121.146345	0.441	BB	BB	BB	BB	BB	BB	AA	AB	BB	BB
7	SNP_A-1643783	rs10487974	122442567	122.442567	0.381	AA	AB	AB	AB	AB	AB	BB	BB	BB	BB
7	SNP_A-1690238	rs6948425	123386447	123.386447	0.476	AA	AA	AB	AB	AB	AB	AA	AB	BB	AB
7	SNP_A-1745008	rs723444	124253175	124.253175	0.417	BB	BB	AB	AB	AB	AB	BB	BB	BB	BB
7	SNP_A-1675675	rs2107098	124969695	124.969695	0.488	BB	AB	AA	AA	AA	AA	BB	AB	BB	AB
7	SNP_A-1678693	rs2299447	125743520	125.74352	0.738	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
7	SNP_A-1670675	rs6467115	126530478	126.530478	0.643	AA	AA	AA	AA	AA	AA	AA	AA	BB	BB
7	SNP_A-1708033	rs10487505	127454114	127.454114	0.464	BB	BB	AB	AB	AB	AB	BB	BB	BB	AB
7	SNP_A-1656498	rs10488628	127961843	127.961843	0.405	AA	AB	AB	AB	AB	AB	AA	AA	AA	AB
7	SNP_A-1742598	rs7803075	130199321	130.199321	0.726	AA	AA	BB	BB	BB	BB	BB	AB	AA	AA
7	SNP_A-1695048	rs1790998	133595635	133.595635	0.476	AA	AA	AB	AB	AB	AB	BB	BB	BB	BB
7	SNP_A-1721434	rs2551778	134556904	134.556904	0.548	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
7	SNP_A-1669022	rs10253975	135674764	135.674764	0.662	BB	AB	AA	AA	AA	AA	AA	AA	AA	AA
7	SNP_A-1715624	rs2253729	139396073	139.396073	0.583	AA	AB	BB	BB	BB	BB	AA	AA	BB	BB
7	SNP_A-1652925	rs1527304	141162389	141.162389	0.571	AA	AA	BB	BB	BB	BB	AA	AA	AA	AB
7	SNP_A-1715016	rs6949653	143162918	143.162918	0.691	AA	AB	AB	AB	AB	AB	AA	AA	AA	AA
7	SNP_A-1666637	rs4725680	144870787	144.870787	0.369	AA	AB	BB	BB	BB	BB	AA	AA	AA	AA
7	SNP_A-1681703	rs10487936	145527849	145.527849	0.732	AA	AA	AA	AA	AA	AA	AA	AA	BB	AB
7	SNP_A-1680321	rs10278315	146403556	146.403556	0.726	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
7	SNP_A-1720798	rs1177946	147495250	147.49525	0.643	AA	AA	AA	AA	AA	AA	AA	AA	BB	BB
7	SNP_A-1713513	rs1403222	149691561	149.691561	0.536	AB	AB	AA	AA	AA	AA	BB	BB	AA	AB
7	SNP_A-1736364	rs306293	154243700	154.2437	0.643	AA	AA	BB	BB	BB	BB	AA	AA	AB	AB
7	SNP_A-1691199	rs2301916	156473603	156.473603	0.369	AB	AB	AB	AB	BB	AB	BB	BB	AB	AB
8	SNP_A-1659972	rs747351	228574	0.228574	0.369	AB	AB	AB	AB	AA	AB	AB	AB	AA	AB
8	SNP_A-1725579	rs4876153	2291741	2.291741	0.691	BB	BB	AA	AA	AA	AA	AA	AA	AA	AB
8	SNP_A-1651465	rs9314492	3332437	3.332437	0.476	AA	AA	BB	BB	BB	BB	BB	BB	BB	AB
8	SNP_A-1695486	rs10503246	4117771	4.117771	0.714	AB	AB	AA	AA	AA	AA	BB	AB	BB	AB
8	SNP_A-1650643	rs4146469	5253259	5.253259	0.441	AB	AB	AB	AB	AB	AB	BB	AB	BB	BB
8	SNP_A-1714359	rs6559072	5839489	5.839489	0.679	AB	AB	AA	AA	AA	AA	BB	BB	AA	AA
8	SNP_A-1660050	rs3020252	6450411	6.450411	0.634	AB	AB	BB	BB	BB	BB	AA	AA	BB	AB
8	SNP_A-1757262	rs2409113	8849712	8.849712	0.72	AB	AB	AA	AA	AA	AA	AA	AA	AA	AA

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
8	SNP_A-1680667	rs1588198	9929939	9.929939	0.655	AB	AB	AB	AB	AB	AB	AA	AB	AA	AA
8	SNP_A-1679891	rs2278335	10740863	10.740863	0.702	AB	AB	AA	AA	AA	AA	AA	AA	AA	AB
8	SNP_A-1715348	rs10503478	13876453	13.876453	0.607	AA	AA	AB	AB	AB	AB	AA	AB	BB	BB
8	SNP_A-1659353	rs2410193	14445035	14.445035	0.738	AA	AA	AA	AA	AA	AA	BB	RB	AA	AB
8	SNP_A-1756484	rs351572	16065839	16.065839	0.595	AA	AA	AA	AA	AA	AA	AA	AA	BB	AB
8	SNP_A-1750990	rs7003503	17226143	17.226143	0.25	BB	BB	AB	AA	AB	AB	BB	BB	BB	AB
8	SNP_A-1688509	rs7006702	19316813	19.316813	0.333	AA	AB	AB	BB	AB	AB	BB	BB	BB	AB
8	SNP_A-1747706	rs2083637	19909455	19.909455	0.738	AA	AB	AB	BB	AB	AB	AB	AB	AA	AA
8	SNP_A-1646595	rs2306518	22526253	22.526253	0.357	BB	AB	BB	BB	BB	BB	BB	BB	AA	AA
8	SNP_A-1699334	rs10503733	23589963	23.589963	0.714	AA	AB	AA	AA	AA	AA	AB	AB	AA	AA
8	SNP_A-1752532	rs2976457	24923988	24.923988	0.548	BB	AB	AA	AA	AA	AA	AB	AB	BB	BB
8	SNP_A-1746191	rs10503776	25765786	25.765786	0.671	BB	BB	AA	AA	AA	AA	AB	AB	AA	AA
8	SNP_A-1742962	rs10503872	30556573	30.556573	0.476	AA	AB	BB	AA	AA	AB	AA	AA	BB	BB
8	SNP_A-1710298	rs10503907	32291552	32.291552	0.607	AA	AA	AA	BB	BB	AB	AB	AB	AA	AB
8	SNP_A-1646333	rs1551652	34443033	34.443033	0.662	AA	AA	BB	AA	AA	AB	BB	BB	AA	AA
8	SNP_A-1679337	rs10503970	34985910	34.98591	0.262	BB	BB	BB	AA	AA	AB	AB	AB	BB	BB
8	SNP_A-1701068	rs581187	37119893	37.119893	0.286	BB	BB	AA	AA	AA	AA	BB	BB	BB	AB
8	SNP_A-1747018	rs3935233	39307991	39.307991	0.31	AA	AB	BB	BB	BB	BB	BB	BB	BB	BB
8	SNP_A-1730295	rs9298596	40431722	40.431722	0.333	AA	AA	BB	AA	AA	AB	BB	BB	BB	BB
8	SNP_A-1664173	rs341817	50186153	50.186153	0.56	AA	AA	AA	BB	BB	AB	AA	AB	BB	AB
8	SNP_A-1712754	rs318913	51075845	51.075845	0.262	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
8	SNP_A-1716236	rs10504120	52554998	52.554998	0.726	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
8	SNP_A-1645251	rs2249236	53110767	53.110767	0.286	AA	AB	AA	BB	AB	AB	AA	AB	BB	BB
8	SNP_A-1674928	rs360956	54063839	54.063839	0.61	BB	BB	BB	AA	AB	AB	AA	AA	BB	BB
8	SNP_A-1661925	rs7824078	55966296	55.966296	0.631	AA	AA	BB	AA	AB	AB	AA	AA	AA	AB
8	SNP_A-1734483	rs2670052	57666163	57.666163	0.583	AA	AB	AA	BB	AB	AB	AA	AA	AA	AA
8	SNP_A-1649879	rs9297980	58641477	58.641477	0.476	AA	AA	AB	BB	AB	AB	AA	AB	AB	AB
8	SNP_A-1689109	rs7012230	62449232	62.449232	0.31	BB	BB	BB	BB	BB	BB	BB	BB	AB	AB
8	SNP_A-1729837	rs874777	65147501	65.147501	0.583	BB	BB	BB	BB	BB	BB	AA	AA	AA	AA
8	SNP_A-1688563	rs977467	67469418	67.469418	0.56	BB	AB	AA	AA	AA	AA	AA	AB	AB	AB
8	SNP_A-1656454	rs900896	68690751	68.690751	0.702	AA	AA	AB	AA	AB	AB	AA	AA	AA	AA
8	SNP_A-1673083	rs1404605	69369253	69.369253	0.585	BB	AB	AA	AA	AA	AA	BB	BB	AA	AA
8	SNP_A-1673921	rs10504451	70626182	70.626182	0.524	AA	AB	BB	BB	BB	BB	AA	AA	AB	AB
8	SNP_A-1660240	rs10504477	71500739	71.500739	0.487	BB	AB	AB	AA	AB	AB	BB	AB	AB	AB
8	SNP_A-1698932	rs2732090	72080811	72.080811	0.5	AA	AB	AA	AA	AA	AA	AA	AB	AB	AB
8	SNP_A-1710462	rs10504526	73129106	73.129106	0.548	AA	AA	AA	AA	AA	AA	BB	AB	AA	AA

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
8	SNP_A-1684163	rs10504552	75038119	75.038119	0.286	BB	BB	AA	AA	AA	AA	AA	AA	AA	AA
8	SNP_A-1673775	rs1375646	76679672	76.679672	0.321	BB	BB	BB	BB	BB	BB	BB	BB	AB	AB
8	SNP_A-1753574	rs1993196	78213269	78.213269	0.583	BB	BB	AA	AA	AA	AA	AB	AB	AA	AA
8	SNP_A-1713893	rs2461063	80781668	80.781668	0.631	AA	AA	AB	BB	AB	AB	AB	AB	AB	AB
8	SNP_A-1650035	rs1199030	81917969	81.917969	0.357	BB	BB	AA	AA	AA	AA	BB	BB	BB	BB
8	SNP_A-1709456	rs1525339	83916405	83.916405	0.738	AA	AA	AA	AA	AA	AA	BB	BB	AA	AA
8	SNP_A-1747972	rs1465809	85243012	85.243012	0.25	BB	BB	BB	BB	BB	BB	BB	BB	AB	AB
8	SNP_A-1690861	rs3808538	86308563	86.308563	0.738	AA	AA	BB	BB	BB	BB	AA	AA	AB	AB
8	SNP_A-1642120	rs10504819	87183400	87.1834	0.369	BB	BB	AA	AA	AA	AA	AA	AA	BB	BB
8	SNP_A-1704458	rs997597	88259667	88.259667	0.274	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
8	SNP_A-1731702	rs10504855	88844371	88.844371	0.345	BB	BB	BB	BB	BB	BB	AB	AB	AB	AB
8	SNP_A-1669078	rs160410	90717844	90.717844	0.658	AA	AA	BB	BB	BB	BB	AA	AA	AA	AA
8	SNP_A-1713264	rs1818193	91886818	91.886818	0.631	AA	AA	AA	AA	AA	AA	AA	AA	AB	AB
8	SNP_A-1679699	rs2245797	95329376	95.329376	0.31	BB	BB	BB	BB	BB	BB	AB	AB	AB	AB
8	SNP_A-1738642	rs962451	101400186	101.400186	0.583	AA	AA	AA	AA	AA	AA	AA	AA	BB	BB
8	SNP_A-1677965	rs4495397	103476369	103.476369	0.268	BB	BB	AA	AA	AA	AA	BB	BB	BB	BB
8	SNP_A-1718730	rs543736	104082125	104.082125	0.619	AB	AB	BB	BB	BB	BB	AA	AB	AA	AA
8	SNP_A-1724051	rs10505064	105831730	105.83173	0.345	AB	AB	BB	BB	BB	BB	BB	AB	BB	BB
8	SNP_A-1691919	rs2930485	107881851	107.881851	0.607	AB	AB	AB	BB	AB	AB	AA	AB	BB	BB
8	SNP_A-1652191	rs10505107	108392560	108.39256	0.619	AA	AA	AB	AA	AB	AB	AA	AA	AA	AA
8	SNP_A-1756952	rs1353298	108959098	108.959098	0.321	BB	BB	BB	BB	BB	BB	BB	BB	AB	AB
8	SNP_A-1695466	rs5772	110167808	110.167808	0.571	AB	AB	AB	BB	AB	AB	AA	AB	AB	AB
8	SNP_A-1747370	rs10505135	111120579	111.120579	0.345	AA	AA	BB	BB	BB	BB	AA	AB	AB	AB
8	SNP_A-1745327	rs10505156	112369457	112.369457	0.25	AB	AB	BB	BB	BB	BB	BB	BB	BB	BB
8	SNP_A-1681911	rs10505180	113392265	113.392265	0.726	AB	AB	AA	AA	AA	AA	AA	AA	AA	AA
8	SNP_A-1694542	rs2125552	113984509	113.984509	0.274	BB	BB	AB	BB	AB	AB	BB	AB	BB	BB
8	SNP_A-1713409	rs9297496	114629527	114.629527	0.321	BB	BB	BB	BB	BB	BB	BB	BB	AB	AB
8	SNP_A-1725803	rs7828185	116438576	116.438576	0.286	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
8	SNP_A-1698988	rs10505328	119219639	119.219639	0.441	AB	AB	BB	BB	BB	BB	BB	BB	BB	BB
8	SNP_A-1753414	rs3924784	121618858	121.618858	0.667	AA	AA	AA	AA	AA	AA	BB	AB	AB	AB
8	SNP_A-1735413	rs17478	122793072	122.793072	0.595	AA	AA	AB	AA	AB	AB	BB	AB	AB	AB
8	SNP_A-1655430	rs6470143	124219594	124.219594	0.345	BB	BB	BB	BB	BB	BB	BB	AB	AA	AA
8	SNP_A-1754805	rs3909562	124803864	124.803864	0.405	AA	AB	AA	AA	AA	AA	BB	BB	AB	AB
8	SNP_A-1696789	rs2382993	125770106	125.770106	0.345	BB	AB	BB	BB	BB	BB	BB	AB	BB	BB
8	SNP_A-1686811	rs897153	126747483	126.747483	0.643	BB	AB	AB	BB	AB	AB	AA	AB	AB	AB
8	SNP_A-1753008	rs2091933	127485749	127.485749	0.679	AA	AB	BB	BB	BB	BB	AA	AA	AB	AB

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
8	SNP_A-1651085	rs10505486	128074016	128.074016	0.441	BB	BB	BB	BB	BB	BB	BB	AB	AB	AB
8	SNP_A-1682761	rs4123791	129288419	129.288419	0.417	BB	BB	AA	AA	AA	AA	AA	AA	AA	AA
8	SNP_A-1692841	rs9297775	129805894	129.805894	0.333	BB	AB	BB	BB	BB	BB	BB	BB	BB	BB
8	SNP_A-1653731	rs10505545	130646449	130.646449	0.538	AA	AA	AB	AB	AB	AB	BB	BB	BB	BB
8	SNP_A-1655374	rs7460225	131408555	131.408555	0.464	AA	AB	AB	AB	AB	AB	AA	AB	AA	AA
8	SNP_A-1672735	rs7008202	132143592	132.143592	0.357	BB	AB	AA	AA	AA	AA	BB	BB	AB	AB
8	SNP_A-1725115	rs4736424	133782292	133.782292	0.31	BB	BB	BB	BB	BB	BB	AA	AB	BB	BB
8	SNP_A-1647079	rs10505607	134527931	134.527931	0.441	AA	AB	BB	BB	BB	BB	BB	BB	AB	AB
8	SNP_A-1700220	rs4909801	135948341	135.948341	0.702	AA	AB	BB	BB	BB	BB	AA	AB	AA	AA
8	SNP_A-1675316	rs4909582	137288153	137.288153	0.488	AA	AA	BB	AB	AB	AB	BB	BB	AA	AA
8	SNP_A-1661056	rs9324439	138086052	138.086052	0.452	BB	AB	BB	BB	BB	BB	BB	BB	AB	AB
8	SNP_A-1689603	rs1325053	139156386	139.156386	0.732	AA	AA	AA	AB	AB	AB	BB	BB	AA	AA
8	SNP_A-1710354	rs2468705	140618265	140.618265	0.75	AB	AB	BB	AB	AB	AB	AA	AA	AA	AA
9	SNP_A-1643050	rs10491691	336963	0.336963	0.655	AB	AB	AA	AA	AA	AA	AB	AB	BB	BB
9	SNP_A-1704718	rs2370220	907667	0.907667	0.726	AA	AA	AB	AB	AB	AB	AA	AA	AA	AA
9	SNP_A-1681445	rs7040916	2645520	2.64552	0.726	BB	BB	AA	AA	AA	AA	AA	AA	AA	AA
9	SNP_A-1734535	rs1358908	3162093	3.162093	0.524	AA	AA	BB	BB	BB	BB	BB	BB	AA	AA
9	SNP_A-1685961	rs1455177	3782613	3.782613	0.488	BB	BB	BB	BB	BB	BB	AB	AB	AB	AB
9	SNP_A-1642494	rs10491650	5193054	5.193054	0.354	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
9	SNP_A-1696419	rs1407473	7989681	7.989681	0.31	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
9	SNP_A-1709516	rs1433548	8927116	8.927116	0.31	AB	AB	AB	AB	AB	AB	BB	BB	BB	BB
9	SNP_A-1682679	rs1613507	9791755	9.791755	0.563	AB	AB	AA	AA	AA	AA	BB	BB	AA	AA
9	SNP_A-1673445	rs10511545	10341048	10.341048	0.726	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
9	SNP_A-1679185	rs4740473	11080005	11.080005	0.369	AB	AB	AA	AA	AA	AA	BB	BB	BB	BB
9	SNP_A-1744452	rs1825739	11777410	11.77741	0.429	BB	BB	BB	BB	BB	BB	AB	AB	AA	AB
9	SNP_A-1714556	rs1086377	12824688	12.824688	0.702	AA	AA	BB	BB	BB	BB	AB	AB	AA	AA
9	SNP_A-1672461	rs7038474	13355816	13.355816	0.702	AB	AB	AA	AA	AA	AA	BB	BB	BB	AB
9	SNP_A-1704214	rs10511587	13970584	13.970584	0.738	AB	AB	AA	AA	AA	AA	AB	AB	AA	AA
9	SNP_A-1714243	rs4615688	14495861	14.495861	0.714	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
9	SNP_A-1741448	rs10511603	15006475	15.006475	0.536	BB	BB	BB	BB	BB	BB	AB	AB	AA	AA
9	SNP_A-1742240	rs1001265	17618726	17.618726	0.726	BB	BB	AA	AA	AA	AA	AA	AA	AA	AA
9	SNP_A-1675206	rs7862683	18257947	18.257947	0.427	BB	BB	AA	AA	AB	AB	AB	AB	BB	BB
9	SNP_A-1706426	rs7859334	20660966	20.660966	0.56	AA	AA	BB	BB	AB	AB	AB	AB	BB	AB
9	SNP_A-1669996	rs871024	21793880	21.79388	0.441	AA	AA	AA	AA	AA	AA	AB	AB	BB	AB
9	SNP_A-1662201	rs10511705	22537789	22.537789	0.512	BB	BB	BB	BB	AB	AB	AB	AB	BB	AB
9	SNP_A-1673761	rs9298846	23216243	23.216243	0.655	AB	AB	AA	AA	AA	AA	AA	AA	AA	AB

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
9	SNP_A-1752066	rs10511761	25602704	25.602704	0.441	BB	BB	BB	BB	BB	BB	AA	AA	AA	AA
9	SNP_A-1690106	rs4978049	26131011	26.131011	0.381	AB	AB	BB	BB	BB	BB	BB	BB	BB	BB
9	SNP_A-1700687	rs983863	26681668	26.681668	0.345	BB	BB	BB	BB	AB	AB	AA	AA	AA	AA
9	SNP_A-1690672	rs1452357	28090846	28.090846	0.707	BB	BB	BB	BB	AB	AB	AA	AA	AA	AA
9	SNP_A-1693514	rs824257	28765262	28.765262	0.655	AA	AA	AA	AA	AA	AA	AA	AA	BB	BB
9	SNP_A-1665553	rs10511842	30009704	30.009704	0.25	AA	AB	BB	BB	AB	AB	BB	BB	AA	AB
9	SNP_A-1724125	rs10511886	31826555	31.826555	0.607	BB	AB	BB	BB	AB	AB	AB	AB	BB	BB
9	SNP_A-1648177	rs20583	33016572	33.016572	0.452	AA	AB	BB	BB	BB	BB	AA	AA	AA	AB
9	SNP_A-1717742	rs6476493	35884737	35.884737	0.691	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
9	SNP_A-1671263	rs4880042	36940301	36.940301	0.393	AA	AA	BB	BB	BB	BB	BB	BB	BB	BB
9	SNP_A-1681599	rs2181139	38364977	38.364977	0.25	BB	AB	AA	AA	AA	AA	AB	AB	BB	AB
9	SNP_A-1666811	rs4111409	40345280	40.34528	0.262	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
9	SNP_A-1727790	rs7864775	69030853	69.030853	0.548	BB	BB	BB	BB	BB	BB	BB	BB	AA	AB
9	SNP_A-1699350	rs10511972	69672094	69.672094	0.619	BB	BB	AA	AA	AA	AB	BB	AB	BB	BB
9	SNP_A-1753754	rs10511984	70399849	70.399849	0.75	AA	AA	AA	AA	AA	AA	AA	AB	AA	AA
9	SNP_A-1748876	rs10511999	71526051	71.526051	0.595	AA	AA	AA	AA	AA	AA	AA	AA	BB	AB
9	SNP_A-1750024	rs1998372	72123726	72.123726	0.369	BB	BB	BB	BB	BB	AB	BB	BB	BB	BB
9	SNP_A-1733975	rs2377524	76002013	76.002013	0.321	BB	BB	BB	BB	BB	BB	BB	BB	BB	AB
9	SNP_A-1707951	rs10512079	78602073	78.602073	0.25	AA	AA	AA	AA	AB	AB	AA	AB	BB	BB
9	SNP_A-1655498	rs1316823	79531349	79.531349	0.643	AB	AB	AA	AA	AA	AA	AA	AA	AA	AA
9	SNP_A-1721234	rs1572147	80160841	80.160841	0.634	AA	AA	AB	AA	AB	AB	AA	AA	BB	AB
9	SNP_A-1757764	rs7873639	80780459	80.780459	0.286	BB	BB	BB	BB	BB	BB	AA	AA	AA	AB
9	SNP_A-1685995	rs2774635	82184146	82.184146	0.286	BB	BB	BB	BB	BB	BB	BB	BB	AA	AB
9	SNP_A-1698246	rs1436932	83903397	83.903397	0.476	AB	AB	AA	AA	AA	AA	AA	AA	AA	AB
9	SNP_A-1743644	rs7030902	85064645	85.064645	0.548	AA	AA	AB	BB	AB	AB	BB	BB	AA	AB
9	SNP_A-1642838	rs1475524	87362117	87.362117	0.357	BB	BB	AB	AA	AB	AB	AA	AB	AA	AA
9	SNP_A-1683979	rs4744114	91732136	91.732136	0.452	BB	BB	AB	AA	AB	AB	BB	BB	AA	AA
9	SNP_A-1645449	rs1547201	95896039	95.896039	0.548	AA	AA	BB	BB	BB	BB	AB	AB	AB	AB
9	SNP_A-1751508	rs1924001	102134812	102.134812	0.643	BB	BB	AA	AA	AA	AA	AB	AB	AA	AA
9	SNP_A-1724479	rs1463983	105506339	105.506339	0.429	BB	BB	AB	AA	AB	AB	BB	BB	AB	AB
9	SNP_A-1653563	rs2418076	110092906	110.092906	0.298	BB	BB	AA	AA	AA	AA	BB	BB	BB	BB
9	SNP_A-1744924	rs1813202	111767658	111.767658	0.286	AB	AB	BB	BB	BB	BB	AB	AB	BB	BB
9	SNP_A-1731818	rs10513222	113757379	113.757379	0.321	BB	BB	AB	BB	AB	AB	AA	AA	BB	BB
9	SNP_A-1733479	rs10513267	115067920	115.06792	0.75	AA	AB	AA	AA	AA	AA	AA	AA	AA	AA
9	SNP_A-1643236	rs4112759	117313823	117.313823	0.75	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
9	SNP_A-1750306	rs7849366	118191918	118.191918	0.286	AA	AA	AB	BB	AB	AB	AB	AB	BB	BB

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
9	SNP_A-1686447	rs10514837	118919482	118.919482	0.321	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
9	SNP_A-1656426	rs10491529	120012279	120.012279	0.25	BB	AB	AB	AB	AB	AB	BB	BB	BB	BB
9	SNP_A-1677789	rs306796	121206889	121.206889	0.631	AA	AA	AA	AA	AA	AA	AA	AA	AB	AB
9	SNP_A-1705544	rs7043602	126285054	126.285054	0.738	AA	AA	AA	AA	AA	AA	AB	AB	AA	AA
9	SNP_A-1653355	rs883335	129165519	129.165519	0.595	BB	BB	AB	AB	AB	AB	AA	AA	AB	AB
9	SNP_A-1699424	rs2269337	130602238	130.602238	0.742	BB	AB	AA	AA	AA	AA	AA	AA	AA	AA
9	SNP_A-1747024	rs2809243	132799854	132.799854	0.298	BB	BB	AA	AA	AA	AA	AB	AB	AA	AA
10	SNP_A-1659685	rs1392827	1234414	1.234414	0.667	AA	AA	AB	AB	AB	AB	AB	AB	AA	AA
10	SNP_A-1753764	rs4880915	1747289	1.747289	0.293	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
10	SNP_A-1727231	rs9329289	2532389	2.532389	0.405	AA	AA	AB	AB	AB	AB	AB	AB	AB	AB
10	SNP_A-1732637	rs2388557	3181527	3.181527	0.321	BB	BB	BB	BB	BB	BB	AB	AB	BB	BB
10	SNP_A-1679829	rs1679440	4468715	4.468715	0.286	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
10	SNP_A-1713889	rs946785	7041660	7.04166	0.595	AA	AA	AB	AB	AB	AB	BB	BB	AB	AB
10	SNP_A-1717612	rs4385796	8539643	8.539643	0.286	BB	BB	BB	BB	BB	BB	BB	BB	AA	AB
10	SNP_A-1740604	rs1762757	9449776	9.449776	0.726	AA	AA	AA	AA	AA	AA	BB	BB	AA	AA
10	SNP_A-1686911	rs10508380	10003736	10.003736	0.738	AA	AA	AB	AB	AA	AB	BB	BB	AA	AA
10	SNP_A-1739848	rs1041044	10644387	10.644387	0.5	BB	BB	AB	AB	BB	AB	AB	AB	BB	BB
10	SNP_A-1721418	rs4750093	11829643	11.829643	0.429	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
10	SNP_A-1739768	rs1108131	12537753	12.537753	0.75	AB	AB	AB	AB	AA	AB	BB	BB	AA	AA
10	SNP_A-1737160	rs564166	13110955	13.110955	0.738	AB	AB	AA	AA	AA	AA	AA	AA	AA	AA
10	SNP_A-1678303	rs10508465	13725194	13.725194	0.429	AA	AA	AB	AB	BB	AB	AB	AB	AA	AA
10	SNP_A-1669628	rs10508473	14241057	14.241057	0.417	BB	BB	BB	BB	BB	BB	AB	AB	AA	AA
10	SNP_A-1714770	rs1361588	16119457	16.119457	0.298	BB	BB	BB	BB	BB	BB	BB	BB	BB	AB
10	SNP_A-1700268	rs10490962	17240369	17.240369	0.56	AB	AB	BB	BB	BB	BB	AB	AB	BB	BB
10	SNP_A-1744374	rs10508555	18316688	18.316688	0.441	AB	AB	AB	AB	BB	AB	BB	BB	BB	BB
10	SNP_A-1748644	rs984292	19028813	19.028813	0.393	BB	BB	AB	AB	AA	AB	BB	BB	AA	AB
10	SNP_A-1686549	rs2358348	19533421	19.533421	0.643	AA	AA	BB	BB	BB	BB	AA	AA	AA	AA
10	SNP_A-1678189	rs788977	21229153	21.229153	0.262	BB	BB	AB	AB	BB	AB	BB	BB	BB	BB
10	SNP_A-1672001	rs1417374	23168481	23.168481	0.298	BB	BB	AA	AA	AA	AA	AA	AA	AA	AB
10	SNP_A-1726471	rs2150651	24829491	24.829491	0.321	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
10	SNP_A-1751938	rs10508686	25367068	25.367068	0.714	AA	AA	AB	AB	AA	AB	AA	AA	AA	AA
10	SNP_A-1713661	rs4747530	25876455	25.876455	0.56	AB	AB	AB	AB	BB	AB	AB	AB	AA	AA
10	SNP_A-1706402	rs10508717	26712334	26.712334	0.524	AA	AA	AB	AB	AA	AB	BB	BB	BB	BB
10	SNP_A-1713649	rs1970631	28271741	28.271741	0.452	AA	AA	BB	BB	BB	BB	AA	AA	AA	AB
10	SNP_A-1707064	rs703041	29265782	29.265782	0.25	BB	BB	AB	AB	BB	AB	BB	BB	BB	AB
10	SNP_A-1755663	rs2776644	30294654	30.294654	0.488	AB	AB	AB	AB	BB	AB	BB	AB	BB	BB

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
10	SNP_A-1679427	rs2490527	32711123	32.711123	0.631	BB	AB	AB	BB	BB	AB	AA	AB	AA	AA
10	SNP_A-1678169	rs2269101	33546185	33.546185	0.286	AA	AB	AB	AA	AA	AB	BB	AB	BB	AB
10	SNP_A-1674978	rs224750	34271036	34.271036	0.619	AA	AA	AA	AA	AA	AA	BB	AB	AA	AA
10	SNP_A-1722205	rs1032408	43808849	43.808849	0.738	AA	AA	BB	BB	BB	BB	AA	AA	AA	AA
10	SNP_A-1700828	rs1583421	45099157	45.099157	0.583	BB	AB	AA	AA	AA	AA	AA	AA	AA	AA
10	SNP_A-1718604	rs10508908	49643864	49.643864	0.5	BB	BB	AA	BB	BB	AB	AA	AB	AB	AB
10	SNP_A-1741518	rs10508929	51841987	51.841987	0.423	AA	AB	AA	BB	BB	AB	BB	BB	AA	AA
10	SNP_A-1674358	rs2339628	52548976	52.548976	0.679	AA	AB	BB	BB	BB	BB	BB	BB	AB	AB
10	SNP_A-1665161	rs1937666	53326630	53.32663	0.464	AB	AB	AA	BB	BB	AB	AA	AB	BB	BB
10	SNP_A-1648887	rs10508976	54302305	54.302305	0.56	BB	BB	BB	AA	AB	AB	AB	AB	BB	BB
10	SNP_A-1660432	rs422296	54965065	54.965065	0.714	AA	AA	BB	AA	AB	AB	AA	AA	AB	AB
10	SNP_A-1642640	rs6481257	58608558	58.608558	0.274	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
10	SNP_A-1697033	rs10509093	60193775	60.193775	0.452	AA	AA	BB	BB	BB	BB	AA	AA	AA	AA
10	SNP_A-1723683	rs4245585	61596196	61.596196	0.286	BB	BB	BB	AA	AB	AB	BB	BB	BB	BB
10	SNP_A-1653973	rs10509139	62150158	62.150158	0.691	AB	AB	AA	AA	AA	AA	AA	AA	AA	AA
10	SNP_A-1713014	rs2787720	63018471	63.018471	0.488	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
10	SNP_A-1667099	rs1255484	65108003	65.108003	0.488	BB	BB	BB	BB	BB	BB	AB	AB	AA	AA
10	SNP_A-1658163	rs7073489	67452445	67.452445	0.274	AB	AB	BB	BB	BB	BB	BB	BB	BB	BB
10	SNP_A-1642112	rs4746654	68476694	68.476694	0.441	AB	AB	BB	BB	BB	BB	BB	BB	AB	AB
10	SNP_A-1720304	rs7918860	70340702	70.340702	0.583	BB	BB	AA	BB	AB	AB	AA	AA	AB	AB
10	SNP_A-1729287	rs10509321	71655739	71.655739	0.298	AB	AB	AA	AA	AA	AA	BB	BB	AB	AB
10	SNP_A-1707688	rs10509334	73110058	73.110058	0.427	BB	BB	BB	BB	BB	BB	AB	AB	AA	AA
10	SNP_A-1654508	rs1865636	77473753	77.473753	0.5	AA	AA	BB	AA	AB	AB	BB	BB	BB	BB
10	SNP_A-1697249	rs10509384	78693188	78.693188	0.726	AB	AB	AA	AA	AA	AA	AB	AB	AB	AB
10	SNP_A-1679101	rs1344967	79197624	79.197624	0.262	AA	AA	BB	BB	BB	BB	BB	BB	AB	AB
10	SNP_A-1748530	rs10509397	79905374	79.905374	0.476	BB	BB	AA	BB	AB	AB	AB	AB	AA	AA
10	SNP_A-1736610	rs7914988	80540330	80.54033	0.441	AB	AB	AA	BB	AB	AB	AA	AA	AB	AB
10	SNP_A-1665139	rs342372	84579316	84.579316	0.536	AB	AB	BB	AA	AB	AB	AA	AA	AB	AB
10	SNP_A-1715818	rs2067731	86973180	86.97318	0.381	BB	BB	AB	AA	AB	AB	BB	BB	AA	AA
10	SNP_A-1689101	rs2949392	87497414	87.497414	0.5	AA	AA	AB	AA	AB	AB	BB	BB	AB	AB
10	SNP_A-1657815	rs391683	90510663	90.510663	0.679	BB	BB	AB	AA	AB	AB	AB	AB	AA	AA
10	SNP_A-1706118	rs303212	91151335	91.151335	0.298	AB	AB	BB	BB	BB	BB	BB	BB	BB	BB
10	SNP_A-1703070	rs747334	92734724	92.734724	0.476	AA	AA	AB	AB	AB	AB	AB	AB	AA	AA
10	SNP_A-1717632	rs716361	93308518	93.308518	0.321	AB	AB	BB	BB	BB	BB	BB	BB	AB	AB
10	SNP_A-1713435	rs2490739	94587885	94.587885	0.631	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
10	SNP_A-1642080	rs3781270	95520148	95.520148	0.607	AA	AA	AA	AA	AA	AA	BB	BB	AB	AB

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
10	SNP_A-1680183	rs10509692	97226588	97.226588	0.583	AB	AB	AB	AB	AB	AB	AA	AA	AB	AB
10	SNP_A-1705694	rs10509700	97884521	97.884521	0.5	AA	AA	AB	AB	AB	AB	AA	AA	BB	BB
10	SNP_A-1753314	rs793515	98978459	98.978459	0.345	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
10	SNP_A-1742188	rs10509754	103711687	103.711687	0.262	AB	AB	BB	BB	BB	BB	BB	BB	AB	AB
10	SNP_A-1716744	rs2451500	106622867	106.622867	0.707	AA	AA	AA	AA	AA	AA	AB	AB	BB	BB
10	SNP_A-1684935	rs10509832	109070424	109.070424	0.667	AA	AA	BB	BB	BB	BB	BB	BB	AB	AB
10	SNP_A-1676403	rs4113	111223756	111.223756	0.369	AA	AA	AB	AB	AB	AB	BB	BB	BB	BB
10	SNP_A-1726183	rs7099088	114343455	114.343455	0.631	AB	AB	AB	AB	AB	AB	AB	AB	AA	AA
10	SNP_A-1732939	rs10509976	115170888	115.170888	0.286	BB	BB	BB	BB	BB	BB	BB	BB	AB	AB
10	SNP_A-1675599	rs2420070	116671318	116.671318	0.548	AB	AB	BB	BB	BB	BB	BB	BB	BB	BB
10	SNP_A-1700278	rs4447088	117536799	117.536799	0.274	BB	BB	BB	BB	BB	BB	AB	AB	AB	AB
10	SNP_A-1660760	rs880977	118409221	118.409221	0.452	AB	AB	AA	AA	AA	AA	AB	AB	AB	AB
10	SNP_A-1747698	rs2619111	118956986	118.956986	0.702	AA	AA	AB	AB	AB	AB	AA	AA	AA	AA
10	SNP_A-1682085	rs10490913	120144426	120.144426	0.537	AB	AB	BB	BB	BB	BB	AB	AB	AB	AB
10	SNP_A-1731688	rs1980030	120960017	120.960017	0.393	AB	AB	BB	BB	BB	BB	AB	AB	BB	BB
10	SNP_A-1641760	rs1326654	122305416	122.305416	0.405	AB	AB	BB	BB	BB	BB	BB	BB	BB	BB
10	SNP_A-1741090	rs2420995	123842994	123.842994	0.393	BB	BB	BB	BB	BB	BB	AB	AB	AB	AB
10	SNP_A-1751948	rs845101	125180422	125.180422	0.631	AB	AB	AA	AA	AA	AA	AA	AA	AA	AA
10	SNP_A-1711689	rs1278305	127801415	127.801415	0.524	BB	BB	BB	BB	BB	BB	AB	AB	BB	BB
10	SNP_A-1715610	rs10510154	128412532	128.412532	0.738	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
10	SNP_A-1706112	rs2251104	130003906	130.003906	0.333	AA	AA	BB	BB	BB	BB	AB	AB	AB	AB
10	SNP_A-1712012	rs1886380	130596834	130.596834	0.702	AA	AA	AB	BB	AA	AB	AA	AA	AB	AB
10	SNP_A-1652639	rs4077516	133237947	133.237947	0.369	AA	AB	BB	BB	BB	BB	BB	BB	AB	AB
11	SNP_A-1727870	rs2499935	5066470	5.06647	0.417	BB	BB	AA	AB	BB	AB	BB	BB	BB	BB
11	SNP_A-1656094	rs2001778	5575584	5.575584	0.452	BB	BB	BB	BB	BB	BB	BB	BB	AB	AB
11	SNP_A-1680969	rs10500667	6284499	6.284499	0.274	BB	BB	AA	AB	BB	AB	BB	BB	BB	BB
11	SNP_A-1656388	rs2595456	6841339	6.841339	0.524	BB	BB	BB	BB	BB	BB	BB	AB	AB	AB
11	SNP_A-1649885	rs3884596	7488751	7.488751	0.571	AB	AB	BB	BB	BB	BB	AA	AB	AB	AB
11	SNP_A-1663461	rs3993279	10627568	10.627568	0.321	BB	BB	AB	AB	AA	AB	BB	BB	BB	BB
11	SNP_A-1723239	rs10500740	11167698	11.167698	0.274	AB	AB	BB	BB	BB	BB	AB	AB	AB	AB
11	SNP_A-1712474	rs1344613	12408280	12.40828	0.31	AB	AB	BB	BB	BB	BB	AB	AB	BB	BB
11	SNP_A-1705810	rs1894131	15104916	15.104916	0.441	AA	AB	AA	AA	AA	AA	AB	AB	BB	BB
11	SNP_A-1674594	rs2190454	17490211	17.490211	0.333	AA	AB	BB	BB	BB	BB	BB	BB	AB	AB
11	SNP_A-1701156	rs211102	18003069	18.003069	0.25	BB	BB	AB	AB	AA	AB	BB	BB	AB	AB
11	SNP_A-1685951	rs894556	19822510	19.82251	0.56	BB	BB	AB	AB	AB	AB	AA	AA	AB	AB
11	SNP_A-1685201	rs10500886	20976742	20.976742	0.607	BB	AB	AA	AA	AA	AA	AA	AA	AA	AA

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
11	SNP_A-1668135	rs6483807	21873219	21.873219	0.5	BB	BB	AA	AB	AB	AB	BB	BB	AA	AA
11	SNP_A-1713403	rs10500927	22398998	22.398998	0.262	BB	AB	BB	BB	BB	BB	AB	AB	AB	AB
11	SNP_A-1697826	rs1600958	23180524	23.180524	0.388	BB	BB	BB	AB	AB	AB	AA	AA	AA	AA
11	SNP_A-1753516	rs975980	24515539	24.515539	0.441	AA	AB	BB	BB	BB	BB	AA	AA	AB	AB
11	SNP_A-1652525	rs10501011	25497059	25.497059	0.417	AA	AB	BB	BB	BB	BB	AA	AA	AB	AB
11	SNP_A-1665219	rs980562	30413393	30.413393	0.726	AA	AB	AA	AB	AB	AB	AB	AB	AA	AA
11	SNP_A-1720570	rs1848394	30965654	30.965654	0.619	BB	BB	BB	AB	AB	AB	BB	BB	BB	BB
11	SNP_A-1749112	rs10488689	31659092	31.659092	0.286	BB	BB	AA	AA	AA	AA	BB	BB	AB	AB
11	SNP_A-1701102	rs1033717	33023147	33.023147	0.342	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
11	SNP_A-1752850	rs2136509	34753380	34.75338	0.537	BB	BB	BB	AB	AB	AB	AA	AA	AB	AB
11	SNP_A-1691121	rs10501163	36830990	36.83099	0.286	AA	AA	AA	AA	AA	AA	AA	AA	BB	BB
11	SNP_A-1725595	rs992118	40016469	40.016469	0.286	BB	AB	AA	AB	AB	AB	AA	AB	BB	BB
11	SNP_A-1667717	rs7102885	40922404	40.922404	0.655	AA	AA	AA	AB	AB	AB	BB	AB	BB	AB
11	SNP_A-1717738	rs1531932	41781058	41.781058	0.643	AA	AA	BB	AB	AA	AB	AA	AA	AA	AA
11	SNP_A-1709380	rs692726	50396846	50.396846	0.321	AA	AA	BB	BB	BB	BB	BB	AB	BB	BB
11	SNP_A-1752494	rs629948	55113024	55.113024	0.643	AA	AA	AA	BB	BB	AB	AA	AA	AA	AA
11	SNP_A-1697650	rs1080800	56067666	56.067666	0.381	AA	AB	BB	AA	AA	AB	BB	AB	BB	BB
11	SNP_A-1658985	rs540505	56621831	56.621831	0.536	AA	AB	BB	BB	BB	BB	BB	AB	BB	AB
11	SNP_A-1749414	rs612688	57333672	57.333672	0.25	BB	BB	BB	BB	BB	BB	AA	AA	BB	BB
11	SNP_A-1698180	rs10501369	57870148	57.870148	0.512	AA	AA	AA	AA	AA	AA	BB	BB	AA	AA
11	SNP_A-1729269	rs1941030	59982334	59.982334	0.56	BB	BB	AA	BB	BB	AB	AB	AB	AA	AA
11	SNP_A-1656934	rs528736	65461684	65.461684	0.393	BB	AB	AB	BB	BB	AB	AA	AA	BB	BB
11	SNP_A-1738462	rs624765	69826722	69.826722	0.714	AA	AB	AA	AA	AA	AA	AA	AA	AA	AA
11	SNP_A-1645461	rs527529	74298448	74.298448	0.573	AA	AA	BB	BB	BB	BB	AB	AB	AA	AA
11	SNP_A-1711405	rs1793483	76653115	76.653115	0.583	AA	AA	AA	AA	AA	AA	AA	AA	AA	AB
11	SNP_A-1739334	rs3819256	77379509	77.379509	0.571	BB	BB	AB	BB	AB	AB	BB	BB	AA	AB
11	SNP_A-1712184	rs7128417	77883622	77.883622	0.25	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
11	SNP_A-1734963	rs483089	78543310	78.54331	0.655	AA	AA	AB	BB	AB	AB	AA	AA	AA	AB
11	SNP_A-1695384	rs1569168	79525377	79.525377	0.441	AB	AB	AB	AA	AB	AB	AA	AA	BB	AB
11	SNP_A-1695760	rs10501496	80598450	80.59845	0.298	AB	AB	AA	AA	AA	AA	AB	AB	AA	AB
11	SNP_A-1679629	rs666649	81460553	81.460553	0.56	AB	AB	AB	BB	AB	AB	AB	AB	BB	AB
11	SNP_A-1674894	rs2000922	82720260	82.72026	0.619	AA	AA	AA	AA	AA	AA	AB	AB	AA	AA
11	SNP_A-1645839	rs7924334	83853909	83.853909	0.714	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
11	SNP_A-1654894	rs10501586	84433725	84.433725	0.726	AA	AA	AA	AA	AA	AA	AB	AB	AA	AB
11	SNP_A-1756404	rs10501612	85594787	85.594787	0.342	BB	BB	BB	BB	BB	BB	AB	AB	BB	BB
11	SNP_A-1722491	rs503952	86520236	86.520236	0.268	AB	AB	BB	BB	BB	BB	BB	BB	AA	AB

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
11	SNP_A-1740548	rs10501723	89922680	89.92268	0.5	AB	AB	AB	AA	AB	AB	AA	AA	AA	AB
11	SNP_A-1741388	rs1528760	90459676	90.459676	0.738	AA	AA	AA	AA	AA	AA	AA	AA	AA	AB
11	SNP_A-1755135	rs10501759	91082163	91.082163	0.537	BB	BB	BB	BB	BB	BB	AA	AA	AA	AA
11	SNP_A-1656446	rs554735	91994827	91.994827	0.524	AB	AB	AA	AA	AA	AA	BB	BB	AA	AB
11	SNP_A-1720756	rs2605592	92842667	92.842667	0.702	AA	AA	AA	AA	AA	AA	AB	AB	BB	AB
11	SNP_A-1672903	rs609493	93708735	93.708735	0.286	BB	BB	BB	BB	BB	BB	AA	AB	BB	AB
11	SNP_A-1659851	rs12627	94442268	94.442268	0.607	AA	AA	AB	AA	AB	AB	BB	BB	AA	AB
11	SNP_A-1649021	rs1940201	95387950	95.38795	0.31	AB	AB	AB	AA	AB	AB	BB	BB	AB	AB
11	SNP_A-1706350	rs10501859	95973889	95.973889	0.298	AB	AB	BB	BB	BB	BB	BB	AB	AB	AB
11	SNP_A-1670058	rs1939713	99567868	99.567868	0.631	AA	AA	AB	AA	AB	AB	BB	AB	AA	AA
11	SNP_A-1712712	rs667504	100221671	100.221671	0.738	AA	AA	AA	AA	AA	AA	AA	AA	AB	AB
11	SNP_A-1729283	rs313403	102697742	102.697742	0.524	AA	AA	BB	BB	BB	BB	AA	AB	AA	AA
11	SNP_A-1643334	rs260818	103425315	103.425315	0.417	BB	BB	BB	BB	BB	BB	BB	BB	AB	AB
11	SNP_A-1690312	rs10502051	104808805	104.808805	0.286	BB	BB	BB	BB	BB	BB	BB	AB	BB	BB
11	SNP_A-1746850	rs10502080	106341710	106.34171	0.346	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
11	SNP_A-1718590	rs2640757	107936868	107.936868	0.31	AA	AA	BB	BB	BB	BB	BB	BB	BB	BB
11	SNP_A-1739572	rs2298501	109571744	109.571744	0.56	AA	AA	BB	BB	BB	BB	BB	BB	BB	BB
11	SNP_A-1742110	rs170486	110202174	110.202174	0.452	AB	AB	AA	AA	AA	AA	AA	AA	AA	AA
11	SNP_A-1720008	rs10502152	111296905	111.296905	0.321	BB	BB	BB	BB	BB	BB	AA	AB	BB	BB
11	SNP_A-1658493	rs7118530	113395335	113.395335	0.357	AA	AB	BB	BB	BB	BB	AA	AA	AA	AA
11	SNP_A-1689389	rs2247060	114257194	114.257194	0.536	BB	AB	BB	BB	BB	BB	BB	AB	BB	BB
11	SNP_A-1652091	rs572619	115738853	115.738853	0.619	AA	AA	BB	BB	BB	BB	AA	AB	AA	AA
11	SNP_A-1737192	rs660443	116265903	116.265903	0.362	AA	AA	AB	AB	AB	AB	AA	AA	AA	AA
11	SNP_A-1643985	rs1219410	121294459	121.294459	0.691	BB	AB	AA	AA	AA	AA	AA	AA	BB	BB
11	SNP_A-1728568	rs872414	122170647	122.170647	0.452	AA	AA	AA	AB	AB	AB	BB	AB	BB	BB
11	SNP_A-1696469	rs2078158	122950070	122.95007	0.333	BB	BB	AA	AB	AB	AB	BB	BB	BB	BB
11	SNP_A-1748196	rs1940751	127447038	127.447038	0.683	AA	AA	AA	AA	AA	AA	AA	AA	BB	BB
11	SNP_A-1741458	rs1368850	130433518	130.433518	0.598	AA	AB	AA	AB	AB	AB	BB	BB	AA	AA
11	SNP_A-1732434	rs748807	131232636	131.232636	0.452	AA	AB	BB	BB	BB	BB	BB	BB	AB	AB
12	SNP_A-1644365	rs7973282	1095178	1.095178	0.738	AA	AA	AA	AA	AA	AA	AA	AB	AA	AA
12	SNP_A-1716332	rs215994	2587421	2.587421	0.274	BB	BB	BB	BB	BB	BB	AA	AB	BB	BB
12	SNP_A-1708039	rs4625554	4286565	4.286565	0.298	AB	AB	BB	BB	BB	BB	BB	BB	BB	BB
12	SNP_A-1727428	rs1861584	5578079	5.578079	0.702	AA	AA	AB	AB	AB	AB	AA	AB	AB	AB
12	SNP_A-1708085	rs4883241	9384549	9.384549	0.369	AA	AA	AB	AB	AB	AB	AA	AA	AB	AB
12	SNP_A-1709352	rs560444	9940542	9.940542	0.321	BB	AB	BB	BB	BB	BB	BB	BB	BB	BB
12	SNP_A-1667917	rs1009954	11789366	11.789366	0.333	BB	BB	AB	AB	AB	AB	BB	BB	BB	BB

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
12	SNP_A-1749536	rs10505774	13327672	13.327672	0.714	AA	AB	AA	AA	AA	AA	BB	BB	AA	AA
12	SNP_A-1696855	rs10492150	14935164	14.935164	0.333	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
12	SNP_A-1680095	rs4366546	18267461	18.267461	0.75	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
12	SNP_A-1714486	rs10505845	19976927	19.976927	0.714	AA	AA	AA	AA	AA	AA	BB	BB	BB	AB
12	SNP_A-1729086	rs4131935	20632200	20.6322	0.738	BB	BB	AA	AA	AA	AA	AB	AB	BB	AB
12	SNP_A-1673313	rs2417981	21483114	21.483114	0.5	BB	BB	AB	BB	AB	AB	AA	AA	AA	AA
12	SNP_A-1645425	rs3884510	24249990	24.24999	0.512	AA	AA	AB	BB	AB	AB	AB	AB	AA	AA
12	SNP_A-1672243	rs10505945	24803300	24.8033	0.381	BB	AB	BB	BB	BB	BB	BB	BB	BB	BB
12	SNP_A-1692085	rs10505972	25379461	25.379461	0.393	BB	AB	AB	AA	AB	AB	AB	AB	BB	AB
12	SNP_A-1674778	rs9300175	27617467	27.617467	0.417	BB	BB	BB	BB	BB	BB	BB	BB	AA	AB
12	SNP_A-1649795	rs148898	29606383	29.606383	0.691	AA	AA	AA	AA	AA	AA	AA	AB	AA	AB
12	SNP_A-1658781	rs10506065	30342307	30.342307	0.417	BB	AB	BB	BB	BB	BB	BB	BB	BB	BB
12	SNP_A-1722521	rs7979386	30966129	30.966129	0.464	AA	AB	AA	BB	BB	AB	AA	AB	AA	AA
12	SNP_A-1705996	rs2593998	32333520	32.33352	0.714	AA	AA	AA	AA	AA	AA	AA	AB	AA	AB
12	SNP_A-1644085	rs1905428	33450742	33.450742	0.512	AA	AA	AA	AA	AA	AA	BB	AB	BB	AB
12	SNP_A-1711331	rs2389276	33989158	33.989158	0.595	AA	AB	BB	AA	AA	AB	BB	AB	BB	AB
12	SNP_A-1692149	rs10506124	37305503	37.305503	0.571	BB	AB	AA	BB	BB	AB	AA	AB	AA	AA
12	SNP_A-1720482	rs7969928	39561348	39.561348	0.393	AA	AA	BB	BB	BB	BB	BB	BB	BB	AB
12	SNP_A-1659791	rs7309345	40585255	40.585255	0.75	BB	BB	AA	AA	AA	AA	AA	AA	AA	AA
12	SNP_A-1754513	rs1369610	41755818	41.755818	0.369	AA	AB	AA	BB	AB	AB	BB	AB	AA	AB
12	SNP_A-1693494	rs1506678	43535759	43.535759	0.631	AA	AB	AA	AA	AA	AA	AA	AA	AA	AA
12	SNP_A-1702318	rs7310869	44951653	44.951653	0.536	AA	AB	BB	BB	BB	BB	AA	AA	BB	BB
12	SNP_A-1748898	rs10506292	49031020	49.03102	0.381	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
12	SNP_A-1733843	rs7968810	52445260	52.44526	0.738	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
12	SNP_A-1712318	rs10506393	56672989	56.672989	0.691	AA	AB	BB	AA	AA	AB	BB	BB	BB	AB
12	SNP_A-1657234	rs3913094	57197682	57.197682	0.655	AA	AA	AA	BB	BB	AB	AA	AA	AA	AB
12	SNP_A-1662747	rs10506408	58834234	58.834234	0.512	AA	AB	AA	AA	AA	AA	BB	AB	AA	AB
12	SNP_A-1688045	rs7308021	61145687	61.145687	0.571	BB	AB	AA	BB	BB	AB	AA	AA	BB	BB
12	SNP_A-1749010	rs513203	62226007	62.226007	0.56	BB	BB	BB	AA	AA	AB	AB	AB	AB	AB
12	SNP_A-1730271	rs1596727	63609374	63.609374	0.583	AA	AA	AA	AA	AA	AA	BB	BB	AA	AA
12	SNP_A-1716970	rs8756	64646019	64.646019	0.595	AA	AA	BB	BB	BB	BB	BB	BB	AB	AB
12	SNP_A-1721334	rs10506514	65583191	65.583191	0.298	AB	AB	BB	BB	BB	BB	BB	BB	AA	AA
12	SNP_A-1646303	rs7313431	66378203	66.378203	0.631	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
12	SNP_A-1695666	rs710779	68249633	68.249633	0.476	AB	AB	BB	AA	AA	AB	AB	AB	BB	BB
12	SNP_A-1700862	rs2567134	69233806	69.233806	0.31	BB	BB	BB	BB	BB	BB	AB	AB	BB	BB
12	SNP_A-1757570	rs7960254	70109323	70.109323	0.405	AB	AB	BB	AA	AA	AB	BB	BB	BB	BB

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
12	SNP_A-1676631	rs10506645	70671767	70.671767	0.31	BB	BB	BB	AA	AA	AB	AB	AB	BB	BB
12	SNP_A-1743470	rs7964705	72103027	72.103027	0.31	AA	AA	BB	AA	AA	AB	AB	AB	BB	BB
12	SNP_A-1660536	rs1396226	73586112	73.586112	0.429	BB	BB	AA	BB	BB	AB	AB	AB	AB	AB
12	SNP_A-1662713	rs1275643	74439702	74.439702	0.393	AB	AB	BB	AA	AA	AB	AB	AB	AA	AA
12	SNP_A-1667227	rs310877	75889008	75.889008	0.274	BB	BB	BB	BB	BB	BB	BB	BB	AB	AB
12	SNP_A-1732426	rs7315131	76389953	76.389953	0.381	AB	AB	AA	AA	AA	AA	AA	AB	AA	AA
12	SNP_A-1667491	rs1796135	77491016	77.491016	0.524	BB	BB	BB	AA	AA	AB	AA	AB	AB	AB
12	SNP_A-1643877	rs1244908	79104469	79.104469	0.631	AA	AA	BB	BB	BB	BB	AA	AB	AB	AB
12	SNP_A-1737202	rs10506839	79948071	79.948071	0.31	AA	AA	BB	BB	BB	BB	AA	AA	AB	AB
12	SNP_A-1700433	rs10506846	80609736	80.609736	0.655	AA	AA	AA	BB	BB	AB	AA	AB	AB	AB
12	SNP_A-1738317	rs892540	81919943	81.919943	0.667	AB	AB	BB	AA	AA	AB	AA	AA	AA	AA
12	SNP_A-1688895	rs7960510	82715458	82.715458	0.274	AB	AB	BB	BB	BB	BB	BB	BB	AB	AB
12	SNP_A-1675076	rs839159	85096176	85.096176	0.726	AB	AB	BB	BB	BB	BB	AA	AA	AB	AB
12	SNP_A-1663055	rs2635067	85762474	85.762474	0.571	AB	AB	AB	AA	AA	AB	AA	AA	BB	BB
12	SNP_A-1727255	rs1019206	87893500	87.8935	0.333	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
12	SNP_A-1657981	rs2731240	89061896	89.061896	0.31	BB	BB	BB	BB	BB	BB	AA	AB	AA	AA
12	SNP_A-1696519	rs924328	91753976	91.753976	0.31	BB	BB	BB	BB	BB	BB	AA	AA	BB	BB
12	SNP_A-1747554	rs4761590	93076279	93.076279	0.655	BB	BB	AA	AA	AA	AA	BB	AB	AB	AB
12	SNP_A-1701918	rs759572	95985503	95.985503	0.524	BB	BB	AB	AA	AB	AB	AB	AB	BB	BB
12	SNP_A-1734475	rs1394380	97055132	97.055132	0.75	AA	AA	AA	AA	AA	AA	AB	AB	AA	AA
12	SNP_A-1690482	rs10492276	97699500	97.6995	0.691	AA	AA	AB	BB	AB	AB	AA	AA	AB	AB
12	SNP_A-1704900	rs1718312	101743655	101.743655	0.393	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
12	SNP_A-1698694	rs10507166	102367680	102.36768	0.369	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
12	SNP_A-1731482	rs7954946	103966503	103.966503	0.333	BB	BB	AA	AA	AA	AA	AA	AA	AA	AA
12	SNP_A-1689283	rs10507197	104564170	104.56417	0.583	AA	AA	AA	AA	AA	AA	BB	BB	AB	AB
12	SNP_A-1723539	rs1444581	105816718	105.816718	0.488	BB	BB	AA	AA	AA	AA	AA	AA	BB	BB
12	SNP_A-1676727	rs715447	107449185	107.449185	0.464	BB	BB	AB	AB	AB	AB	BB	BB	AB	AB
12	SNP_A-1742456	rs10507234	108519202	108.519202	0.714	AB	AB	AA	AA	AA	AA	AB	AB	AA	AA
12	SNP_A-1655216	rs4767550	116413870	116.41387	0.595	AA	AA	AB	AB	AB	AB	AA	AA	AB	AB
12	SNP_A-1673501	rs1726392	117061645	117.061645	0.321	BB	AB	AB	AB	AB	AB	BB	BB	BB	BB
12	SNP_A-1748666	rs3858710	118701913	118.701913	0.573	AA	AB	AA	AA	AA	AA	AA	AA	AB	AB
12	SNP_A-1708029	rs1558062	124778387	124.778387	0.524	AA	AB	AB	AB	AB	AB	AA	AB	AA	AA
12	SNP_A-1716508	rs345676	126581103	126.581103	0.643	AA	AB	BB	BB	BB	BB	BB	AB	AA	AA
12	SNP_A-1664795	rs1983314	129393207	129.393207	0.333	BB	AB	BB	BB	BB	BB	AB	AB	BB	BB
13	SNP_A-1652867	rs7985257	18787997	18.787997	0.524	BB	BB	AA	AA	AA	AA	BB	AB	AA	AA
13	SNP_A-1686943	rs535233	20445317	20.445317	0.321	AB	AB	BB	BB	BB	BB	BB	BB	AA	AB

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
13	SNP_A-1745741	rs2862901	23933239	23.933239	0.571	AB	AB	AA	AA	AA	AA	BB	AB	AA	AA
13	SNP_A-1642868	rs10507349	25679528	25.679528	0.274	BB	BB	AA	AA	AA	AB	BB	BB	AB	AB
13	SNP_A-1702806	rs1161470	28322644	28.322644	0.31	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
13	SNP_A-1664657	rs213611	30348913	30.348913	0.705	AA	AA	AA	AA	AA	AA	AB	AB	AB	AB
13	SNP_A-1658585	rs206079	31818618	31.818618	0.417	BB	BB	BB	BB	BB	BB	AB	AB	AB	AB
13	SNP_A-1685897	rs4941700	32383381	32.383381	0.262	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
13	SNP_A-1664201	rs1538001	33683068	33.683068	0.274	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
13	SNP_A-1742432	rs6563348	35588714	35.588714	0.397	AA	AA	BB	BB	BB	BB	AB	AB	BB	BB
13	SNP_A-1709846	rs2224655	36217500	36.2175	0.298	BB	BB	BB	BB	BB	BB	AB	AB	AA	AA
13	SNP_A-1719156	rs1359214	36774982	36.774982	0.452	AB	AB	AA	AA	AA	AA	AB	AB	AB	AB
13	SNP_A-1699940	rs10507466	37361657	37.361657	0.75	AA	AA	AA	AA	AA	AA	AB	AB	AB	AB
13	SNP_A-1757710	rs2197879	38143188	38.143188	0.286	AB	AB	BB	BB	BB	BB	BB	BB	AA	AA
13	SNP_A-1725889	rs4566029	39136387	39.136387	0.691	AA	AA	AA	AA	AA	AA	AB	AB	AA	AA
13	SNP_A-1648291	rs7322754	40220977	40.220977	0.31	BB	BB	BB	AB	AB	AB	BB	BB	BB	BB
13	SNP_A-1644487	rs1409075	42143450	42.14345	0.5	AB	AB	AB	AB	AB	AB	AA	AA	AA	AA
13	SNP_A-1692131	rs9316020	42892291	42.892291	0.274	BB	BB	AB	AB	AB	AB	BB	BB	BB	BB
13	SNP_A-1683729	rs9285153	43710570	43.71057	0.536	BB	BB	BB	BB	BB	BB	AB	AB	AB	AB
13	SNP_A-1675092	rs10507544	46298746	46.298746	0.286	BB	BB	BB	BB	BB	BB	AB	AB	AB	AB
13	SNP_A-1706220	rs1983805	48609971	48.609971	0.655	AA	AA	AA	AA	AA	AA	BB	AB	AA	AA
13	SNP_A-1656586	rs1359613	49664241	49.664241	0.381	AA	AB	AA	AA	AA	AA	BB	BB	AB	AB
13	SNP_A-1687875	rs9316513	50452286	50.452286	0.643	AA	AB	AA	AA	AA	AA	BB	AB	AA	AA
13	SNP_A-1699260	rs1891948	52537146	52.537146	0.429	BB	BB	AA	AA	AA	AA	AA	AB	BB	BB
13	SNP_A-1670827	rs9316642	53093973	53.093973	0.571	AA	AB	BB	BB	BB	BB	BB	BB	BB	BB
13	SNP_A-1664927	rs1010947	53921670	53.92167	0.702	AA	AB	AA	AA	AA	AA	AA	AA	AA	AA
13	SNP_A-1686045	rs10507599	54585799	54.585799	0.286	AA	AB	BB	BB	BB	BB	BB	BB	BB	BB
13	SNP_A-1686285	rs2253408	55216697	55.216697	0.75	AA	AA	AB	AB	AB	AB	BB	AB	BB	BB
13	SNP_A-1668215	rs959745	56718869	56.718869	0.274	BB	BB	BB	BB	BB	BB	BB	AB	BB	BB
13	SNP_A-1706400	rs10492603	57769822	57.769822	0.679	AA	AA	BB	BB	BB	BB	AA	AA	AA	AA
13	SNP_A-1695368	rs2786664	59574054	59.574054	0.417	BB	BB	BB	BB	BB	BB	BB	BB	AA	AA
13	SNP_A-1690895	rs3102221	60652316	60.652316	0.488	AA	AB	AB	AB	AB	AB	AA	AB	AA	AA
13	SNP_A-1731184	rs7323089	61693413	61.693413	0.56	AA	AA	AA	AA	AA	AA	AA	AB	AA	AA
13	SNP_A-1697063	rs2134898	62767058	62.767058	0.25	BB	BB	AA	AA	AA	AA	BB	AB	BB	BB
13	SNP_A-1707522	rs9317406	63717021	63.717021	0.417	BB	AB	BB	BB	BB	BB	BB	BB	AB	AB
13	SNP_A-1645393	rs7321823	65570977	65.570977	0.679	BB	BB	AA	AA	AA	AA	AA	AA	AA	AA
13	SNP_A-1726077	rs10492592	66385683	66.385683	0.714	AA	AB	AB	AB	AB	AB	AA	AA	AB	AB
13	SNP_A-1650731	rs176343	68069259	68.069259	0.702	AA	AB	AA	AA	AA	AA	AA	AA	AA	AA

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
13	SNP_A-1705084	rs2782448	68801734	68.801734	0.643	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
13	SNP_A-1715042	rs3909263	71753222	71.753222	0.321	BB	BB	AB	AB	AB	AB	AA	AA	BB	BB
13	SNP_A-1732673	rs10507812	72886773	72.886773	0.75	AA	AA	AB	AB	AB	AB	BB	BB	AA	AA
13	SNP_A-1713643	rs9318226	73391987	73.391987	0.419	BB	BB	AA	AA	AA	AA	AA	AA	BB	BB
13	SNP_A-1756880	rs9318324	74649787	74.649787	0.658	AA	AA	BB	BB	BB	BB	AA	AA	AB	AB
13	SNP_A-1685215	rs10507835	75353682	75.353682	0.691	AA	AA	AA	AA	AA	AA	BB	AB	AA	AA
13	SNP_A-1679595	rs1952548	76037205	76.037205	0.333	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
13	SNP_A-1687191	rs7326108	77781442	77.781442	0.393	AB	AB	AA	AA	AA	AA	BB	BB	AB	AB
13	SNP_A-1680379	rs3903388	78802822	78.802822	0.393	BB	BB	AB	AB	AB	AB	AA	AA	BB	BB
13	SNP_A-1664955	rs1215462	79594011	79.594011	0.536	BB	BB	AB	AB	AB	AB	AB	AB	BB	BB
13	SNP_A-1727874	rs1744600	80158809	80.158809	0.631	AB	AB	AB	AB	AB	AB	BB	BB	AA	AA
13	SNP_A-1710116	rs10507917	80741431	80.741431	0.488	AA	AA	AA	AA	AA	AA	BB	BB	AB	AB
13	SNP_A-1663633	rs9318868	81947326	81.947326	0.643	AB	AB	AA	AA	AA	AA	AA	AA	AB	AB
13	SNP_A-1693530	rs9319022	83601961	83.601961	0.345	BB	BB	AB	AB	AB	AB	AB	AB	AB	AB
13	SNP_A-1706422	rs1331567	84793816	84.793816	0.56	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
13	SNP_A-1733077	rs995475	87558036	87.558036	0.357	AB	AB	BB	BB	BB	BB	AB	AB	BB	BB
13	SNP_A-1679861	rs1113478	88908389	88.908389	0.417	AA	AA	AB	AA	AB	AB	AB	AB	AB	AB
13	SNP_A-1649205	rs665530	90571947	90.571947	0.726	AA	AA	AA	AA	AA	AA	AB	AB	AA	AA
13	SNP_A-1726887	rs1926489	91465990	91.46599	0.524	AB	AB	AA	AA	AA	AA	AA	AA	AB	AB
13	SNP_A-1714183	rs913005	92275844	92.275844	0.607	AB	AB	BB	BB	BB	BB	AA	AA	AA	AA
13	SNP_A-1701716	rs9301876	92819688	92.819688	0.56	AA	AA	BB	BB	BB	BB	AA	AA	AA	AA
13	SNP_A-1681625	rs1412938	93661657	93.661657	0.726	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
13	SNP_A-1648409	rs9302001	94261393	94.261393	0.274	AA	AA	BB	BB	BB	BB	AB	AB	BB	BB
13	SNP_A-1741482	rs7324781	95032754	95.032754	0.405	AB	AB	BB	BB	AB	AB	BB	BB	BB	BB
13	SNP_A-1661319	rs4603415	96610639	96.610639	0.631	AB	AB	AA	AA	AA	AA	AB	AB	AA	AB
13	SNP_A-1664929	rs285067	97536416	97.536416	0.691	AA	AB	BB	BB	AB	AB	AA	AA	AA	AA
13	SNP_A-1709292	rs1886553	98448739	98.448739	0.486	BB	BB	AA	AA	AB	AB	AA	AA	BB	AB
13	SNP_A-1749428	rs2760306	99841672	99.841672	0.298	BB	BB	BB	BB	BB	BB	AB	AB	BB	BB
13	SNP_A-1703098	rs10508075	101237184	101.237184	0.464	AA	AB	AA	AA	AB	AB	AB	AB	AA	AA
13	SNP_A-1680317	rs1015795	102023701	102.023701	0.488	AA	AB	BB	BB	BB	BB	AA	AA	BB	BB
13	SNP_A-1704124	rs279927	102539019	102.539019	0.643	AA	AA	AA	AA	AA	AA	AA	AA	BB	AB
13	SNP_A-1752530	rs1033147	103460337	103.460337	0.333	AA	AA	BB	BB	BB	BB	AB	AB	BB	BB
13	SNP_A-1654228	rs9300981	104440279	104.440279	0.286	BB	AB	BB	BB	BB	BB	AB	AB	BB	AB
13	SNP_A-1715354	rs7318881	105459909	105.459909	0.671	BB	BB	AA	AA	AA	AA	BB	BB	BB	BB
13	SNP_A-1645715	rs7327250	106243682	106.243682	0.329	BB	AB	BB	BB	BB	BB	BB	AB	BB	BB
13	SNP_A-1756346	rs1320446	106965333	106.965333	0.679	BB	BB	BB	BB	AB	AB	BB	AB	AA	AA

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
13	SNP_A-1732084	rs231604	107524007	107.524007	0.381	AA	AA	BB	BB	BB	BB	BB	BB	BB	BB
13	SNP_A-1681321	rs4772985	108080882	108.080882	0.25	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
13	SNP_A-1648777	rs10492480	108947427	108.947427	0.333	BB	BB	AA	AA	AA	AA	AA	AA	BB	BB
13	SNP_A-1654860	rs2183850	110513987	110.513987	0.714	BB	BB	AA	AA	AA	AA	BB	BB	AA	AA
14	SNP_A-1733261	rs1952805	19586195	19.586195	0.345	BB	BB	BB	BB	BB	BB	BB	BB	AB	AB
14	SNP_A-1702470	rs1923	22511019	22.511019	0.429	BB	AB	AA	AA	AA	AA	AB	AB	AA	AA
14	SNP_A-1645139	rs4983041	24495978	24.495978	0.595	BB	AB	AB	AA	BB	AB	AA	AA	AB	AB
14	SNP_A-1676969	rs10483331	26546808	26.546808	0.417	AB	AB	BB	BB	BB	BB	AB	AB	AA	AA
14	SNP_A-1680111	rs4981658	27234585	27.234585	0.732	AA	AA	AA	AA	AA	AA	AB	AB	AA	AA
14	SNP_A-1734437	rs2333423	28146939	28.146939	0.381	AB	AB	BB	BB	BB	BB	BB	BB	BB	BB
14	SNP_A-1669916	rs10483350	28885906	28.885906	0.738	AA	AA	BB	BB	BB	BB	AA	AA	AA	AA
14	SNP_A-1732697	rs225842	29622687	29.622687	0.441	AB	AB	BB	BB	BB	BB	AB	AB	AB	AB
14	SNP_A-1656700	rs1278891	31464813	31.464813	0.595	AA	AA	AB	AA	AB	AB	BB	BB	AB	AB
14	SNP_A-1740154	rs9322929	33377471	33.377471	0.345	AB	AB	AB	BB	AB	AB	BB	BB	BB	BB
14	SNP_A-1757044	rs799493	34621626	34.621626	0.691	AB	AB	AB	BB	AB	AB	AA	AA	AA	AA
14	SNP_A-1676887	rs847498	35546428	35.546428	0.607	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
14	SNP_A-1665507	rs1950361	36101975	36.101975	0.329	AB	AB	BB	BB	BB	BB	AB	AB	AB	AB
14	SNP_A-1705178	rs4901596	37659956	37.659956	0.667	AB	AB	AA	AA	AA	AA	AB	AB	BB	BB
14	SNP_A-1654996	rs6571869	38248210	38.24821	0.679	AA	AA	AB	AB	AB	AB	AB	AB	AA	AA
14	SNP_A-1708854	rs10483511	39587714	39.587714	0.571	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB
14	SNP_A-1653001	rs10498360	40670723	40.670723	0.476	AB	AB	BB	BB	BB	BB	BB	BB	AB	AB
14	SNP_A-1753660	rs1951874	41387217	41.387217	0.345	AA	AA	AB	AB	AB	AB	BB	BB	AA	AA
14	SNP_A-1653419	rs2010338	45895631	45.895631	0.655	AA	AA	BB	BB	BB	BB	AA	AA	AA	AA
14	SNP_A-1663303	rs10483573	46932227	46.932227	0.357	BB	BB	AA	AA	AA	AA	AA	AA	AB	AB
14	SNP_A-1664801	rs698340	47611853	47.611853	0.585	AB	AB	AA	AA	AA	AA	AA	AA	BB	BB
14	SNP_A-1722201	rs7146291	48172131	48.172131	0.274	BB	BB	BB	BB	BB	BB	BB	BB	AB	AB
14	SNP_A-1650017	rs8006972	48690753	48.690753	0.31	BB	BB	AB	AB	AA	AB	AA	AA	AB	AB
14	SNP_A-1720778	rs10498420	49483793	49.483793	0.476	AB	AB	AB	AB	BB	AB	AB	AB	BB	BB
14	SNP_A-1743320	rs963626	50157439	50.157439	0.691	AA	AA	AA	AA	AA	AA	AB	AB	AA	AA
14	SNP_A-1641756	rs1956574	51163026	51.163026	0.655	AA	AA	AA	AA	AA	AA	AA	AA	AB	AB
14	SNP_A-1669704	rs7151306	52273870	52.27387	0.607	AB	AB	BB	BB	BB	BB	AA	AA	AB	AB
14	SNP_A-1748272	rs877018	52892776	52.892776	0.451	BB	BB	AB	AB	AA	AB	AB	AB	AB	AB
14	SNP_A-1714357	rs1382978	55788938	55.788938	0.536	AA	AA	BB	BB	BB	BB	AA	AB	AA	AA
14	SNP_A-1714205	rs10483679	56503799	56.503799	0.61	BB	AB	AB	AB	AA	AB	AA	AA	AB	AB
14	SNP_A-1654106	rs238376	57129665	57.129665	0.357	AA	AB	BB	BB	BB	BB	AA	AB	AB	AB
14	SNP_A-1690578	rs10498488	58658876	58.658876	0.451	BB	BB	AB	AB	BB	AB	AA	AA	AA	AA

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
14	SNP_A-1690058	rs9323353	59240800	59.2408	0.619	AA	AA	AB	AB	AA	AB	AA	AA	AA	AA
14	SNP_A-1671347	rs2296274	60986931	60.986931	0.75	BB	AB	AA	AA	AA	AA	AA	AA	AB	AB
14	SNP_A-1755551	rs9285590	61521469	61.521469	0.417	AA	AA	AA	AA	AA	AA	BB	AB	BB	BB
14	SNP_A-1707294	rs1271582	64634456	64.634456	0.441	BB	BB	AA	AA	AA	AA	BB	BB	BB	BB
14	SNP_A-1648725	rs10483805	67325404	67.325404	0.329	BB	AB	AB	AB	BB	AB	BB	BB	AB	AB
14	SNP_A-1699466	rs1956528	67858721	67.858721	0.631	BB	BB	AA	AA	AA	AA	BB	AB	AB	AB
14	SNP_A-1682431	rs749397	69414068	69.414068	0.262	BB	BB	AA	AA	AA	AA	BB	BB	BB	BB
14	SNP_A-1674164	rs2215132	71545542	71.545542	0.262	AA	AB	BB	BB	BB	BB	AA	AA	AB	AB
14	SNP_A-1672631	rs2803971	72182227	72.182227	0.713	AA	AA	AA	AA	AA	AA	AA	AA	AB	AB
14	SNP_A-1648423	rs1028258	75447775	75.447775	0.726	AA	AA	AB	AB	BB	AB	AA	AA	AA	AA
14	SNP_A-1700204	rs7152153	76265708	76.265708	0.286	BB	BB	BB	BB	BB	BB	AA	AA	BB	BB
14	SNP_A-1701478	rs7156671	76991628	76.991628	0.7	AA	AA	AB	AB	BB	AB	AA	AA	BB	BB
14	SNP_A-1706776	rs10483905	78043978	78.043978	0.429	BB	BB	AA	AA	AA	AA	BB	BB	BB	BB
14	SNP_A-1667157	rs997842	78614233	78.614233	0.679	AA	AA	AA	AA	AA	AA	AA	AB	AB	AB
14	SNP_A-1722889	rs2049826	79383063	79.383063	0.345	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
14	SNP_A-1645339	rs2372083	81860288	81.860288	0.452	AB	AB	AA	AA	AA	AA	BB	AB	AB	AB
14	SNP_A-1704748	rs2372424	83017248	83.017248	0.438	AA	AA	BB	BB	BB	BB	AA	AA	BB	BB
14	SNP_A-1757272	rs8003423	83533541	83.533541	0.643	BB	BB	AB	AB	AA	AB	AA	AA	AA	AA
14	SNP_A-1644835	rs1530325	84781909	84.781909	0.702	AB	AB	AA	AA	AA	AA	AA	AB	AB	AB
14	SNP_A-1680733	rs10498604	86238836	86.238836	0.298	BB	BB	BB	BB	BB	BB	BB	BB	AB	AB
14	SNP_A-1702796	rs8018273	86867956	86.867956	0.524	AA	AA	BB	BB	BB	BB	AA	AA	AA	AA
14	SNP_A-1687761	rs429923	87481126	87.481126	0.405	BB	BB	AA	AA	AA	AA	AA	AA	BB	BB
14	SNP_A-1725723	rs1742083	90256423	90.256423	0.321	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB
14	SNP_A-1661389	rs10498627	91041872	91.041872	0.583	AA	AA	BB	BB	BB	BB	AA	AA	AB	AB
14	SNP_A-1705392	rs2148567	93244403	93.244403	0.286	BB	BB	BB	BB	BB	BB	AA	AA	BB	BB
14	SNP_A-1734665	rs1456988	97557760	97.55776	0.679	AB	AB	AA	AA	AA	AA	AA	AA	BB	BB
14	SNP_A-1684765	rs200331	98457298	98.457298	0.488	AB	AB	AA	AA	AA	AA	AB	AB	AA	AA
14	SNP_A-1682935	rs3918051	99023837	99.023837	0.61	BB	AB	AA	AA	AA	AA	AB	AB	AA	AA
14	SNP_A-1734911	rs10484072	102695759	102.695759	0.631	AA	AA	AB	AB	AB	AB	BB	BB	AB	AB
14	SNP_A-1659209	rs1048257	104475429	104.475429	0.667	AA	AA	AB	AB	AB	AB	BB	BB	AB	AB
15	SNP_A-1669336	rs1405186	21306806	21.306806	0.441	BB	AB	BB	BB	BB	BB	BB	BB	BB	BB
15	SNP_A-1690082	rs2169637	25517776	25.517776	0.262	BB	BB	AA	AA	AA	AA	BB	BB	BB	BB
15	SNP_A-1643639	rs10519635	27330404	27.330404	0.607	BB	BB	AB	AB	AB	AB	BB	AB	BB	AB
15	SNP_A-1740804	rs4779462	28026287	28.026287	0.598	BB	BB	AB	AB	AB	AB	AA	AA	AA	AA
15	SNP_A-1722463	rs2219507	29646927	29.646927	0.691	AA	AA	AA	AA	AA	AA	BB	AB	AA	AA
15	SNP_A-1730684	rs10519737	30756749	30.756749	0.381	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
15	SNP_A-1648795	rs1343900	31431890	31.43189	0.667	AA	AA	AB	AB	AB	AB	AA	AB	BB	BB
15	SNP_A-1755583	rs10519956	32849133	32.849133	0.345	AB	AB	BB	BB	BB	BB	BB	BB	AA	AB
15	SNP_A-1699406	rs1948650	33827340	33.82734	0.738	AA	AA	AA	AA	AA	AA	AB	AB	AA	AB
15	SNP_A-1645977	rs10518868	34381353	34.381353	0.655	AA	AA	AB	AB	AB	AB	AB	AB	AA	AA
15	SNP_A-1665819	rs471122	41345866	41.345866	0.3	AA	AA	BB	BB	BB	BB	BB	BB	AA	AB
15	SNP_A-1673073	rs10519044	44169166	44.169166	0.381	BB	BB	AB	AB	AB	AB	BB	BB	BB	BB
15	SNP_A-1740676	rs493728	48678247	48.678247	0.441	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
15	SNP_A-1709940	rs1478200	51948279	51.948279	0.357	BB	AB	BB	BB	BB	BB	AB	AB	BB	BB
15	SNP_A-1720532	rs2553222	52657040	52.65704	0.691	BB	BB	AA	AA	AA	AA	AB	AB	AA	AB
15	SNP_A-1654466	rs4534776	55408068	55.408068	0.463	AA	AA	AB	AB	AB	AB	AB	BB	BB	AB
15	SNP_A-1752856	rs1550574	56000660	56.00066	0.536	AA	AA	BB	BB	BB	BB	AA	AA	AA	AB
15	SNP_A-1735597	rs2033721	58609267	58.609267	0.714	AA	AB	AB	AB	AB	AB	AA	AA	AA	AB
15	SNP_A-1642536	rs3935962	59611593	59.611593	0.536	AA	AB	AA	AA	AA	AA	AA	AA	AA	AB
15	SNP_A-1726387	rs10519148	60507655	60.507655	0.25	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
15	SNP_A-1750348	rs2652824	61207054	61.207054	0.286	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
15	SNP_A-1741266	rs10518707	65152676	65.152676	0.488	AA	AB	AB	AB	AB	AB	AA	AA	AA	AA
15	SNP_A-1739192	rs305002	67928959	67.928959	0.595	AA	AA	AA	AA	AA	AA	BB	BB	BB	BB
15	SNP_A-1677047	rs2128112	69973340	69.97334	0.262	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
15	SNP_A-1698770	rs3898352	74308825	74.308825	0.631	BB	AB	AB	AB	AA	AB	BB	BB	AA	AA
15	SNP_A-1654378	rs1446312	75199244	75.199244	0.738	AA	AA	AA	AA	AA	AA	AB	AB	AA	AB
15	SNP_A-1657306	rs7163689	76352533	76.352533	0.488	AA	AB	AB	AB	AA	AB	AB	AB	BB	BB
15	SNP_A-1701268	rs1001460	77291934	77.291934	0.56	AA	AA	AB	AB	BB	AB	AB	AB	AA	AB
15	SNP_A-1689635	rs1320323	79128502	79.128502	0.59	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
15	SNP_A-1749864	rs1846911	80255705	80.255705	0.329	AA	AA	BB	BB	BB	BB	AB	AB	BB	BB
15	SNP_A-1714319	rs10520585	83462510	83.46251	0.286	BB	AB	AB	AB	AA	AB	BB	BB	BB	AB
15	SNP_A-1654264	rs1961601	84030610	84.03061	0.31	BB	BB	AB	AB	AA	AB	BB	BB	BB	AB
15	SNP_A-1650691	rs1122907	84708371	84.708371	0.691	AA	AA	AB	AB	BB	AB	AA	AA	AA	AA
15	SNP_A-1665669	rs10520655	85887415	85.887415	0.595	BB	AB	AA	AA	AA	AA	AA	AA	AA	AB
15	SNP_A-1694944	rs3817428	87216251	87.216251	0.75	AA	AA	AA	AA	AA	AA	AB	AB	AA	AA
15	SNP_A-1683397	rs1079537	89675287	89.675287	0.452	AB	AB	AB	AB	AA	AB	BB	BB	BB	BB
15	SNP_A-1752072	rs10520710	90688998	90.688998	0.287	BB	BB	BB	BB	BB	BB	BB	AB	BB	AB
15	SNP_A-1731798	rs1989269	91611056	91.611056	0.305	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
15	SNP_A-1728656	rs10520754	92760413	92.760413	0.548	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
15	SNP_A-1700188	rs4321143	93957372	93.957372	0.262	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB

TABLE 18-continued

Database S2.
Database S2 Heterozygosity or phESC (Abbreviated as "pC") Lines

chromo-some	SNP ID	RS ID (dbSNP)	basepair	basepair (Mb)	Freq A in Caucasian	pC-1	pC-1 donor	pC-3	pC-4	pC-5	N3-5 donor	pC-6	pC-6 donor	pC-7	pC-7 donor
15	SNP_A-1686439	rs1551466	99344619	99.344619	0.345	AB	AB	AB	AB	AB	AB	BB	BB	AB	AB
15	SNP_A-1647533	rs352716	100155950	100.15595	0.31	AA	AA	BB	BB	BB	BB	BB	AB	AA	AA

The results show heterozygosity of derived phESC lines and displays changes in genotype by comparison with the related donor genotype. Portions of heterozygous segments of the donor genome became homozygous in phESC. Chromosome-chromosome number; RS ID-RS number in dbSNP database; Base pair-base pair distance as recorded by Affimetrix GeneChip; Freq A in Cauc-the frequency of A allele in Caucasian population.

In prior research, parthenogenetic activation of mouse oocytes has resulted in homozygous embryonic stem cell lines (Lin et al., Stem Cells (2003) 21:152). In human oocytes, the suppression of the second meiotic division after oocyte parthenogenetic activation and the generation of diploid embryos does not lead to the derivation of wholly homozygous hES cells.

Based on the HLA-typing results, differentiated cells derived from all phESC lines should be wholly histocompatible with the oocyte donors, making this a method to create cells of therapeutic use (Table 19).

TABLE 19

HLA-typing for phESC cell lines

	MHC I			MHC II		
	HLA-A	HLA-B	HLA-C	DRB1	DQB1	DQA1
phESC-1	A*01	B*15(63)	Cw*04	DRB1*12	DQB1*06	DQA1*01
	A*02	B*35	Cw*0708	DRB1*13	DQB1*03	DQA1*0505
phESC-1	A*01	B*15(63)	Cw*04	DRB1*12	DQB1*06	DQA1*01
donor	A*02	B*35	Cw*0708	DRB1*13	DQB1*03	DQA1*0505
phESC-3, 4, 5	A*02	B*52	Cw*03	DRB1*01	DQB1*05	DQA1*0101
	A*03	B*22	Cw*04	DRB1*03	DQB1*02	DQA1*05
phESC-3, 4, 5	A*02	B*52	Cw*03	DRB1*01	DQB1*05	DQA1*0101
donor	A*03	B*22	Cw*04	DRB1*03	DQB1*02	DQA1*05
phESC-6	A*02	B*07	Cw*04	DRB1*04	DQB1*06	DQA1*01
	A*03	B*27	Cw*07	DRB1*15	DQB1*03	DQA1*03
phESC-6	A*02	B*07	Cw*04	DRB1*04	DQB1*06	DQA1*01
donor	A*03	B*27	Cw*07	DRB1*15	DQB1*03	DQA1*03
phESC-7	A*01	B*38	Cw*06	DRB1*13	DQB1*06	DQA1*0106
	A*02	B*57	Cw*12	DRB1*14	DQB1*06	DQA1*0103
phESC-7	A*01	B*38	Cw*06	DRB1*13	DQB1*06	DQA1*0106
donor	A*02	B*57	Cw*12	DRB1*14	DQB1*06	DQA1*0103
NSF	A*25	B*15(62)	Cw*12	DRB1*04	DQB1*06	DQA1*01
	A*32	B*18	Cw*12	DRB1*15	DQB1*03	DQA1*03

DNA-profiling of the genetic material derived from the human fibroblasts used as feeder cells revealed no contamination of the phESC cell lines with material from the human fibroblasts (Table 19).

The phESC-1 line remained undifferentiated during ten months of culture, spanning 35 passages. The other cell lines were successfully cultivated over at least 21 passages. The cells from all phESC lines formed cystic embryoid bodies in suspension culture and gave rise to derivatives of all three germ layers: ectoderm, mesoderm, and endoderm, after differentiation in vitro (FIG. **4**). Approximately 5% of embryoid bodies from the phESC-1 line gave rise to beating cells five days following plating. The phESC-6 line produced pigmented epithelial-like cells (FIG. **4**I, K). Ectoderm differentiation is presented by positive immunocytochemical staining for neuron specific markers neurofiliment 68 (FIG. **4**A), NCAM (FIG. **4**B), beta III-tubulin (FIG. **4**C) and the glial cell marker GFAP (FIGS. **4**D, M). Differentiated cells were positive for mesoderm markers including alpha-actinin (FIG. **4**G) and desmin (FIG. **4**J), which are muscle specific markers, and the endothelial markers PECAM-1 (FIG. **4**E) and VE-Cadherin (FIG. **4**F). Endoderm differentiation is presented by positive staining of differentiated derivatives for alpha-fetoprotein. These data demonstrate that phESC can be differentiated into the three germ layers that lead to all cell types of a human body.

The altered karyotype of phESC-7 may be a reason to exclude it form clinical use. Alterations of genomic imprinting in human embryos can contribute to the development of disorders linked to maternally or paternally expressed genes (Gabriel et al., Proc Natl Acad Sci USA (1998) 95:14857). In order to investigate other characteristics of the phESC lines, and to determine their suitability for use in cell therapy, imprinting analysis was performed.

Northern blots were made and screened with DNA probes SNRPN, Peg1_2, Peg1_A, H19, and GAPDH (as an internal control) as outlined above. Blotted nucleic acids were obtained from NSF, neonatal skin fibroblasts; hES, human embryonic stem cell line derived from fertilized oocytes; 1,

phESC-1; 2, phESC-3, 3, phESC-4, 4, phESC-5; 5, phESC-6; 6 phESC-7. NSF RT-, hES RT-, 1 RT- are negative controls. FIG. **3** shows the results of the imprinting blot.

The maternal imprinting gene, Peg1_A shows strong binding in all of the cell lines tested. Weaker (relative to Peg1_A), but consistent binding was observed in all of the cell lines for the maternal imprinting gene H19. SNRPN shows binding predominantly in NSF, hES, phESC-4, and phESC-6. Peg1_2 shows binding predominantly in NSF, hES, phESC-1 (weaker signal), phESC-3, phESC-5, and phESC-6. GAPDH binding confirmed similar loading of RNA in all lanes.

Although the invention has been described with reference to the above examples, it will be understood that modifications and variations are encompassed within the spirit and scope of the invention. Accordingly, the invention is limited only by the following claims.

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What is claimed is:

1. A method of producing human stem cells comprising:

a) parthenogenetically activating a human oocyte, wherein activating comprises: i) contacting the oocyte with an ionophore at high O_2 tension and ii) contacting the oocyte with a serine-threonine kinase inhibitor under low O_2 tension;

b) cultivating the activated oocyte of step (a) at low O_2 tension until blastocyst formation;

c) transferring the blastocyst to a layer of feeder cells, and culturing the transferred blastocyst under high O_2 tension;

d) mechanically isolating an inner cell mass (ICM) from trophectoderm of the blastocyst of step (c); and

e) culturing the cells of the ICM of step (d) on a layer of feeder cells, wherein culturing step (e) is carried out under high O_2 tension, thereby producing human stem cells.

2. The method of claim **1**, wherein low O_2 tension is maintained by incubation in a gas mixture environment comprising an O_2 concentration of about 2% O_2 to about 5% O_2.

3. The method of claim **2**, wherein the gas mixture environment further comprises about 5% CO_2 and about 90% N_2 to 93% N_2.

4. The method of claim **1**, wherein high O_2 tension is maintained by incubation in a gas mixture environment comprising about 5% CO_2 and about 20% O_2.

5. The method of claim **1**, wherein the ionophore is selected from the group consisting of ionomycin and A23187.

6. The method of claim **1**, wherein the serine-threonine kinase inhibitor is selected from the group consisting of staurosporine, 2-aminopurine, sphingosine, and 6- dimethylaminopurine (DMAP).

7. The method of claim **1**, wherein the activating, isolating, and culturing steps are carried out under defined media conditions for therapeutic applications.

8. The method of claim **7**, wherein the media comprises human umbilical cord serum.

9. The method of claim **8**, wherein the media comprises about 10% human umbilical cord serum.

10. The method of claim **1**, wherein the layer of feeder cells comprises human fibroblasts.

11. The method of claim **10**, wherein the fibroblasts are postnatal human dermal fibroblasts.

12. The method of claim **10**, wherein the feeder cells are inactivated with an antibiotic.

13. The method of claim **12**, wherein the antibiotic is mitomycin C.

14. A method of activating a human metaphase II oocyte comprising;

a) incubating a human metaphase II oocyte in in vitro fertilization (IYF) media;

b) incubating the cell of step (a) in IVF media comprising an ionophore;

c) incubating the cell of step (b) in IYF media comprising a serine-threonine kinase inhibitor; and

d) incubating the cells of step (c) in fresh IVF medium until blastocyst formation,

wherein the incubating steps (a) and (b) are carried out under high O_2 tension, and wherein an inner cell mass (ICM) obtained from the blastocyst at step (d) produce culturable stem cells.

15. The method of claim **14**, wherein the O_2 tension for incubating steps (c) and (d) is maintained by incubating the cells in a gas mixture environment comprising an O_2 concentration of about 2% O_2 to 5% O_2.

16. The method of claim **15**, wherein the gas mixture environment further comprises about 5% CO_2 and about 90% N_2 to 93% N_2.

17. The method of claim **14**, further comprising incubating the oocytes with hyaluronidase.

18. The method of claim **14**, wherein incubating step (a) is carried out for about 2 hours at about 37° C.

19. The method of claim **14**, wherein incubating step (b) is carried out for about 5 minutes at about 37° C.

20. The method of claim **14**, wherein incubating step (c) is carried out for about 4 hours at about 37° C.

21. The method of claim **14**, wherein incubating step (d) is carried out for about 24 hours at about 37° C.

22. The method of claim **14**, wherein the IVF media is free of non-human products.

23. The method of claim **22**, wherein the ionophore is selected from the group consisting of ionomycin and A23187.

24. The method of claim **23**, wherein the ionophore is ionomycin.

25. The method of claim **22**, wherein the serine-threonine kinase inhibitor is selected from the group consisting of staurosporine, 2-aminopurine, sphingosine, and 6- dimethylaminopurine (DMAP).

26. The method of claim **25**, wherein the serine-threonine kinase inhibitor is DMAP.

* * * * *